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REED (G. M.). **Phytopathology—1867–1942.**—*Torreya*, xliii, 2, pp. 155–169, 1943.

In this paper the author reviews the history of phytopathological research from 1867 to 1942, the main points dealt with being the life-history and classification of the fungous pathogens, physiologic specialization, the importance of environmental factors in relation to disease outbreaks, bacterial and virus diseases, breeding for resistance, methods of disease control, and research and teaching.

LEACH (J. G.) & MULLIN (J. R.). **The daily flight of Aster leafhoppers as determined by a light trap.**—*Bull. W. Va Univ.*, Ser. 42, 8–11, pp. 93–95, 2 graphs, 1942.

As one phase of a comprehensive study of the blue stem or purple top wilt disease of potatoes [*R.A.M.*, xxii, p. 493], the writers have investigated the migration of the aster leafhopper, *Macrosteles divisus*, from cereals and grasses to potatoes over the period from May to August, 1939 and 1940, and the factors controlling their movements. The insects were much more numerous in 1939 than in 1940, and the incidence of purple top was correspondingly higher in the former than in the latter year. There were two distinct peaks of migration in both years, but they fell at different times and yielded no evidence of any inherent tendency to move at a given moment, neither was any influence of maturity of the alternate hosts on the migration of the leafhoppers to potatoes apparent.

LOUGHNANE (J. B.). **Aphis rhamni Boyer ; its occurrence in Ireland and its efficiency as a vector of Potato viruses.**—*J. Dep. Agric. Éire*, xl, 2, pp. 291–298, 1943.

A survey of the aphis population of potato crops carried out during 1938, 1939, 1940, and 1941 in Eire showed that *Aphis rhamni* occurs in large numbers in several seed-growing districts. The capacity of this species, whose life-history, world distribution, and description are given in detail, to transmit potato viruses was experimentally established during 1940 and 1941. The results suggest that *A. rhamni* is a more efficient vector of virus Y than of leaf roll, and, as indicated by a single experiment, is not as efficient a vector of leaf roll as *Myzus persicae*. No precise information is available on the effectiveness of *A. rhamni* under field conditions. However, there are certain factors, such as lateness of arrival and the tendency to remain on the leaf on which it was produced, which would tend to operate against any large scale transmission by this species. It is, therefore, concluded that *A. rhamni* is of no importance as a vector of potato viruses in the field. This view is supported by the fact that in the districts where this aphis occurs abundantly, seed potatoes have been grown for many years without any noticeable increase in the incidence of virus diseases in the crops.

BALD (J. G.) & NORRIS (D. O.). **Transmission of Potato virus diseases. 1. Field experiment with leaf roll at Canberra, 1940–41; 2. The aphis population of Potatoes at Canberra, during 1940–41.**—*Bull. Coun. sci. industr. Res. Aust.* 163, 31 pp., 5 graphs, 2 diags., 1943.

In this paper are described the first controlled experiments on the spread of

potato leaf roll in Australia [*R.A.M.*, xxiii, p. 74]. Steep gradients of infection suggested a limited range of dispersal of the aphis vectors. In the first of the two experimental blocks of plants, adjacence to a leaf roll plant appeared to have little influence on the likelihood of a healthy plant becoming infected; in the second, the percentage of infection among healthy plants adjacent in the same row to a diseased one was higher than among more distant ones. Analysis of the figures for the latter block suggested that direct transmission from original sources to neighbouring plants in the same row would account for about 80 per cent. infection among those plants, the effect of this type of transmission falling off very rapidly with increasing distance from the sources. It is assumed that the figure for direct, or neighbour, infection represents short-range dispersal of the virus mainly by wingless aphids crawling from diseased to healthy plants. It was calculated that indirect or secondary infection alone would have accounted for an average of 66 per cent. infection throughout the block. This type of transmission, from unidentified sources, may be due to either the dispersal of winged aphids, to secondary infections from plants infected during the current season, or to the infection of plants progressively more distant from the original source by infective aphids migrating considerable distances along rows and feeding successively on a number of plants.

Discussing the variations in the populations on potato of the two leaf roll vectors, *Macrosiphum gei* and *Myzus persicae*, relative to season and weather, the author states that hot, dry weather depresses the population of both species. Use was made of the ratio of immature to adult forms as a multiplication index in comparing populations. Inverse variations in the numbers of the two species are explained on the basis of greater destruction of adults of *Macrosiphum gei* and nymphs of *Myzus persicae* by heavy rain. The observed concentration of population of *Macrosiphum gei* on the bottom leaves of potatoes, which is the reverse of the condition reported in other countries, is believed to be due to a decreased rate of mortality in this region of the plant.

YOUNKIN (S. G.). **Diseased Daisies menace upstate Potato crop.**—*Fm Res.*, ix, 3, pp. 6–7, 2 figs., 1943. [Abs. in *Exp. Sta. Rec.*, xc, 1, pp. 66–67, 1944.]

Clovers have generally been assumed to serve as alternate hosts and perpetuate the virus of yellow dwarf [*R.A.M.*, xxii, p. 399], one of the most serious of the 20 or more virus diseases of potatoes occurring in New York, especially from the standpoint of certified seed production. It has lately been observed, however, that potatoes separated by many miles from clovers may become infected, and 45 out of 137 weeds tested for the presence of yellow dwarf were shown to be capable of harbouring the virus. Under field conditions, only one out of 842 medium red clover plants was found to be infected, and none of the 544 of two other clover species carried the virus. In the same fields, of 374 plants of *Chrysanthemum leucanthemum* var. *pinnatifidum* 168 were infected, of 211 of *Rudbeckia hirta* 1, of 287 of *Barbarea vulgaris* 3, and of 1,324 of eight other species none. Infected plants of *C. leucanthemum* var. *pinnatifidum* are able to survive the winter with a relatively low mortality rate. Migration of the clover leafhopper [*Aceratagallia sanguinolenta*] vector to potato fields reaches a climax during periods of drought or at times when preferred food plants are scarce. The maximum infection of potatoes consequently occurs in dry seasons, and the heaviest losses are experienced in the following year when diseased tubers are planted. Of the potato varieties commonly grown in the State, Green Mountain and Rural are the most susceptible and Katahdin and Sebago [ibid., xxiii, p. 185] among the most resistant to yellow dwarf. Care should be taken to avoid planting susceptible varieties adjacent to fields containing large populations of *C. leucanthemum* var. *pinnatifidum*: where

isolation is impracticable, seed should be saved only from the centre of the field, and in all cases the numbers of perennial weeds should be reduced to a minimum.

WALLACE (MAUD M.). **Diseases of Potatoes.**—*Mycol. Leafl. Dep. Agric. Tanganyika* 17, 10 pp., 1943.

In connexion with the first appearance of potato late blight (*Phytophthora infestans*) in the Northern Province of Tanganyika in 1942 [*R.A.M.*, xxii, p. 493], and its subsequent spread to the Usambara and Uluguru Mountains, the writer describes in popular terms the symptoms of this disease and other well-known pathogens of the same crop in the Territory, and gives directions for their control, largely by improved cultural methods, supplemented in the case of late blight by spraying or dusting with copper-containing compounds. The other potato diseases discussed are early blight (*Alternaria solani*), *Sclerotinia sclerotiorum* (found once, in 1943, in the Moshi district), black scurf and stem canker (*Corticium solani*), troublesome in parts of the Usambara Mountains, *Sclerotium rolfsii*, first observed in the Territory in 1943, black dot (*Colletotrichum atramentarium*), common scab (*Actinomyces scabies*), powdery scab (*Spongospora subterranea*), mosaic, internal brown fleck [ibid., xvii, p. 160], spraing, and storage rots, including *Fusarium coeruleum*.

FERNOW (K. H.). **Potato ring rot control for those who think they don't have the disease.**—*Amer. Potato J.*, xxi, 1, pp. 14–17, 1944.

A five-year programme is outlined for the production of seed potatoes, to be applied only where ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, xxiii, p. 118] is believed to be altogether absent or present in not more than one hill in 10,000. The first year, 100 hills should be dug by hand, each being examined for symptoms of ring rot. If any are found, the attempt should be abandoned. Assuming that 100 healthy hills have been dug, the tubers should be picked directly into new crates and stored in these through the winter. Next year the tubers should be cut with a knife which has been previously disinfected in boiling water for five minutes and planted by hand to avoid danger of transferring infection from other plots. The resulting plot should consist of 1,000 hills (or more). Of these, 100 hills (preferably those first planted) should again be dug by hand in the autumn, and the remainder with a digger, with due precautions to prevent contamination in field or storage. The third year, a 1,000-hill plot should be planted with the product of the 100 hills dug by hand the previous year and a one-acre plot planted with the product from the remainder. This should be repeated yearly till the original 100 hills expand to 100 acres after about five years. The method has not been tested experimentally but is proposed as a practical aid to seed-growers until better methods are worked out.

LECLERG (E. L.). **Non-virus leafroll of Irish Potatoes.**—*Amer. Potato J.*, xxi, 1, pp. 5–13, 4 figs., 1944.

A non-virus leaf roll, very similar to that caused by the virus, is stated to occur frequently in Irish potato seedling varieties under southern conditions in Louisiana, and to appear nearly every spring in first-tuber propagations from seedlings grown from true seed the previous autumn. The nature of the disease is not yet completely understood, but it appears to be an inheritable character and its expression is probably conditioned by environmental factors and the interaction of length of storage period and dormancy. Marked differences in the degree of rolling were found in both seedling and named varieties of Irish potatoes, a few of those tested being relatively free from the trouble. Progenies from crosses and inbred lines differed considerably in the percentage of segregates subject to rolling. Freedom from rolling was inherited by a high percentage of the progeny in a few

crosses or inbreds, indicating possible lines of potato-breeding work. The assumption of a non-virus nature of the disease rests on the following facts: (1) no appreciable increase of rolling occurs with continued propagation; (2) the percentage of primes is maintained with continued propagation; (3) almost without exception every plant of a given variety, if subject to rolling, is affected to approximately the same degree; and (4) stem-graft tests substantiate observational differentiation between non-virus and virus leaf roll to a high degree.

TURNER (C. N.). **Custom Potato spraying in New York aids the war.**—*Amer. Potato J.*, xxi, 1, pp. 17–20, 1944.

During the last three years a type of sprayer new to New York State (but used in Maine since 1931) is stated to have facilitated the organization of a large spraying-service ring, where a large group of potato growers can be served by one spraying outfit. The number of these outfits has increased from 12 in 1941 to 35 in 1943, with a probable total of 70 for 1944. These 70 outfits are expected to spray about 17,000 acres. The new type consists of a ten-row tractor-mounted sprayer and a water-supply truck equipped with a large tank and water-pumping appliances. The outfits are usually owned by the operator who, with his helper on the truck, sprays the grower's potatoes from six to eight times at 7- to 10-day intervals throughout the season, at a cost of about $2.00 per acre for each 10 : 10 : 100 Bordeaux application. The outfit is very compact and manœuvrable and can be guided between the rows better than any other type of field-sprayer. The outfit is far superior to anything a small grower could afford to own, and operates at smaller cost, which is even further reduced when operators use the tractor to plough, harrow, plant, and dig as well as spray.

HARTMAN (L. E.). **Potato wart in Pennsylvania.**—*Proc. Pa Acad. Sci.*, xvii, pp. 71–77, 2 maps, 1943.

Since 1918, when potato wart [*Synchytrium endobioticum*] was first detected in Pennsylvania, annual surveys for the presence of the disease have been conducted, and up to and including 1942 a total of 1,031 infected gardens had been located in 77 towns or villages in 15 counties. The present quarantine areas comprise the whole of four townships and 29 scattered towns and villages in ten counties. All wart surveys are now limited to areas where mean soil temperatures favour or permit the development of the pathogen, i.e., those with a growing season of 140 days or less. Since 1936 no new foci were discovered until August, 1942, when the disease was observed over a radius of one mile at an elevation of 2,000 to 2,200 ft. in adjoining sections of Susquehanna, Lackawanna, and Wayne Counties, the number of gardens involved being 102 out of 457 planted.

The following salient facts have emerged from the researches of the Department of Agriculture. Wart disease, unless transported by artificial means, spreads very slowly. The fungus persists for many years in favourable soils and will rapidly re-establish itself. Soil temperatures are a limiting factor in the development of *S. endobioticum*, which thrives at 60° to 64° F. and is inhibited at 70° to 74°. Several commercial varieties, e.g., Green Mountain, Cobbler, and Spaulding Rose, are immune, but 90 per cent. of those grown in the State are susceptible. Eradication by chemical treatment of infested soils has given encouraging results in plot and field tests, complete freedom from wart having been obtained, for instance, by the use of ammonium thiocyanate [*R.A.M.*, xix, 426] at the rate of 2,000 lb. and upwards per acre, followed if necessary by 'spot treatment' (of individual infected hills and adjoining soil for a radius of 9 sq. ft.) with mercuric chloride. In the large eastern wart area of the State, embracing 752 infested gardens in 42 towns and villages, which has been under quarantine for 20 years and where only immune varieties are grown, 50 per cent. or more of the gardens are now

estimated to be entirely free from the disease, while in perhaps half the remainder infection is so slight that 'spot treatment' will probably suffice for complete eradication. A re-survey of this area in 1940 further showed that 210 infected or suspected gardens had been eliminated by culm dams, stripping operations, and the like.

JODON (N. E.) & BEACHELL (H. M.). **Rice dwarf mutations and their inheritance.**—*J. Hered.*, xxxiv, 5, pp. 155–160, 3 figs., 1943.

Four types of dwarf mutations in rice [cf. *R.A.M.*, xxi, p. 96], viz., thickset, intermediate, grassy, and double, were collected in Texas, Arkansas, and Louisiana between 1936 and 1941. In crosses with normal plants, thickset and grassy behaved as simple recessives. The F_1 plants of grassy × thickset were of normal height, while the F_2 revealed a 9 : 3 : 3 : 1 ratio of normal, grassy, thickset, and double dwarf, respectively, the last-named appearing as a double recessive class.

TRUNINGER (E.). **Versuche und Untersuchungen über die Wirkungen des Bors als Spurenelement.** [Experiments and studies on the effects of boron as a trace element.]—*Annu. agric. Suisse*, lviii, 1, pp. 1–36, 9 figs., 1944. [French summary.]

A whole group of non-parasitic plant diseases formerly attributed to lime injury or an excessively alkaline soil reaction has now been recognized as proceeding from boron deficiency, and hence curable by the application of boron-containing fertilizers. The element is present in all cultivated soils, originating for the most part in tourmaline, an aluminium-boron silicate encountered in the majority of rocks. Tourmaline itself, however, owing to its slowness of disaggregation, is not a very good direct source of boron, even large quantities of the mineral, in a finely pulverized state, failing to compensate for the lack of boron on a limed, slightly acid soil. On soils of this type, boron alone or in conjunction with a complete fertilizer of neutral reaction has effected no improvement, except in the case of plants with an exceptionally high boron requirement, such as beets. Only after the treatment of the soil with large quantities of lime, inducing an alkaline reaction and consequent injury to the crops from boron deficiency, did the application of the latter element arrest the falling-off in yield or even produce a substantial increase.

In fertilizer experiments with a number of vegetable, fodder, and cereal crops, boric acid, even at the minimum rate of 5 kg. per ha., increased the boron content of the plants, in most cases by several times the normal amount. The multiplication of the element was chiefly conspicuous in the vegetative organs, but its beneficial effects were primarily noticeable in the reproductive system. The addition of lime to the boron fertilizer proved to be not only unnecessary, but in some cases even detrimental. Cereals, the poorest in boron of all the plants investigated [*R.A.M.*, xvi, p. 582], were the least affected either by over-liming or the administration of a boron fertilizer. The application of lime nearly always caused a more or less acute shortage of boron in the plants so treated, usually coupled with an increase of nitrogen. After being supplied with boron, the plants were able to make a more economical use of the nutrients comprised in the remaining constituents of the fertilizer, i.e., they required smaller amounts of mineral substances for the production of a unit of dry matter. The proportion of boron withdrawn during growth by the various crops normally ranged from 5 to 20 per cent. of the quantity supplied, though in exceptional cases these percentages were exceeded, e.g., by field [broad] beans (42·3) and buckwheat (55·3). The after-effects of boron have not yet been adequately investigated, but the element is unlikely to persist for more than two or three years in the soil owing to the ease with which the borates are washed out.

In pot experiments with mustard on the effect of simultaneous increases in the dosage of boron and carbonate of lime, very good results were obtained with a minimum dose at the rate of 5 kg. per ha. (0·0157 gm. per pot) of the former (as boric acid) in proportion to the maximum application (50 gm. per pot) of the latter. At the rate of 50 kg. per ha., boron caused a reduction of yield, with a correspondingly more severe drop at the 100 kg. dose. The maximum total (seed and straw) yield of 48·9 gm. per pot was secured by the incorporation with the soil of 50 gm. lime and boric acid (at the rate of 25 kg. per ha.), closely followed by yields of 46·4 and 43·7 gm. resulting from a combination of 25 or 5 gm. lime and boric acid at the 5 kg. rate respectively, with a minimum of 14·5 gm. (all straw) with no lime and boric acid at 100 kg. It is apparent from these figures that plentiful liming is an essential accompaniment to the boron treatment, which should not be regarded as an economical substitute for other fertilizers.

The deficiency of boron in the soil after heavy lime applications is attributable to the absorption of the former by the sesquioxides, which are precipitated by the development of an alkaline reaction. There is no question of the formation of semi-insoluble calcium borates. Unlike lime carbonate, gypsum even in large quantities causes no boron shortage.

The superiority of Chile saltpetre to the synthetic sodium saltpetre rests on the boron content of the natural product, the differences in the action of the two fertilizers on flax, mustard, and tomatoes being particularly noticeable on freshly limed soil. The addition of boron to synthetic sodium saltpetre equalizes the disparity. Besides Chile saltpetre, light ashes from cement works are the only mineral fertilizer in common use containing appreciable amounts of boron, but in tests on mustard and beet the beneficial effects of this product were too slight to be of any practical importance. In experiments on flax the yield was increased by treatment of the soil with liberal doses of boron-containing marl, in which the element occurs in excessively fine particles and is therefore more effective than equivalent amounts of borax or boric acid.

Symptoms of boron deficiency include poor root development, the system consisting merely of a few thread-like, brown roots and minute laterals with short clubbed ends, e.g., in flax, lucerne, mustard, carrots, and radishes, accompanied in the two last-named by gaping longitudinal fissures and cup-shaped depressions; absence of bacterial nodules in the Leguminosae; reduction of the leaf surface, an abnormally dark green coloration, frequently combined with increased pubescence and lustre as aids to transpiration; an erect position of the leaves; the attempted replacement of the main shoot and growing point by the continuous production from the rootstock of abortive adventitious shoots (this phenomenon is particularly characteristic of flax and barley, and has also been observed in cases of beet heart and root rot); and most important of all, scanty flower and fruit growth, especially involving the petals and stamens.

Pinck (L. A.) & Allison (F. E.). **The synthesis of lignin-like complexes by fungi.**—*Soil Sci.*, lvii, 2, pp. 155–161, 1944.

The synthesis of lignin-like complexes by 12 cultures of Hyphomycetes grown on a mineral-sucrose medium was investigated and the average percentage values found were as follows: *Cladosporium* sp. and *C. fulvum*, 21·1; *Helminthosporium* (two isolates), 19·0; *Humicola* sp., 8·1; *Dematium* [*Pullularia*] *pullulans*, 7·1; *Alternaria*, 6·8; *Aspergillus niger*, *A. giganteus*, *Gliocladium fimbriatum*, 2·4, and *Metarrhizium*, 3·6, these figures representing the non-nitrogenous portion of the fungal substance that resisted digestion with 72 per cent. sulphuric acid. Generally speaking, the black or brown fungi contained larger proportions of lignin complexes than the colourless or pale ones.

Under optimum growth conditions, i.e., at or just above P_H 7 and in the presence

of sufficient trace elements, some 40 to 50 per cent. of the carbon of the sucrose was converted into cell material by *C.*, *H.*, and *G.* spp., the corresponding values for the remaining organisms ranging from 25 to 30 per cent. The carbon : nitrogen ratios of the fungal material varied between 10·7 and 22·4 per cent., with an average value of 15·3.

Since the high-lignin organisms grow chiefly on rotting vegetation at or above soil-level, the kind of system used in stubble mulch or trash mulch farming would be expected to promote an abundant yield of humus.

MUNDKUR (B. B.). **Tilletia tumefaciens, a remarkable gall-forming smut from India.**—*Phytopathology*, xxxiv, 1, pp. 143–146, 2 figs., 1944.

The writer has recently published a description [*R.A.M.*, xx, p. 179] of the unique gall-forming smut, *Tilletia tumefaciens* Syd., abundant material of which was collected in 1942 at Rohtak, 30 miles west of New Delhi, on a medicinal plant, *Panicum antidotale*. The pathogen attacks the basal axillary buds, causing them to swell into a globose, black mass, consisting of several united galls simulating a single one. In severe cases the central bud enlarges into a finger-like tumour containing the kaiser-brown to hazel (Ridgway), reticulate spores, nearly black in the mass, which measure 16 to 23 (mean 19·3 μ) in diameter. Three to five such tumours may be seen emerging at one node when several buds are infected. The scale leaves become hairy, swollen, considerably elongated, and completely occupied by the spores of the smut. The powerful trimethylamine odour [ibid., xi, p. 775; xii, p. 277] characteristic of wheat bunt [*Tilletia caries* and *T. foetida*] emitted by the galls attracts insects, which disseminate the spores over considerable distances.

Briefly discussing the limits of the genus *Tilletia*, the author points out that its proposed restriction by Ciferri to the ovariicolous smuts [ibid., xvii, p. 841] fails to recognize the basis of the separation of the Tilletiaceae from the Ustilaginaceae on spore germination and other morphological characters rather than on the location of the sori in the host.

OSORIO TAFALL (B. F.). **La gomosis de la Caña de Azúcar.** [Sugar-cane gummosis.] —*Fitófilo*, ii, 1, pp. 61–82, 7 figs., 1943. [Abs. in *Exp. Sta. Rec.*, xc, 1, p. 67, 1944.]

In this general account of sugar-cane gummosis (*Phytomonas vascularum*) [*Xanthomonas vasculorum*], the author treats of the disease under the aspects of its geographical distribution, etiology, symptomatology, morbid anatomy, natural and artificial transmission, varietal reactions, alternate hosts, and preventive measures. A bibliography of 30 references is appended.

YAMAFUGI (K.), SO (K.), & NAGANO (K.). **Über Atmung und Katalasewirkung beim viruskranken Zuckerrohr.** [On respiration and catalase action in virus-diseased Sugar-Cane.]—*Biochem. Z.*, cccxv, 5–6, pp. 405–410, 1943.

A tabulated account is given of experiments conducted at the Imperial University, Fukuoka, Japan, the results of which showed the catalase activity of mosaic-diseased sugar-cane leaves to be much weaker than that of healthy ones. For instance, reckoning the catalase activity of a sound leaf at 100, the corresponding figure for an infected one was 61. Evidence was further secured pointing to the enclosure of the host cell catalase in the high-molecular virus protein during the process of virus multiplication, so that the activity of the enzyme can only be exerted under appropriate conditions after the splitting-up of the virus.

RISCHKOV [RYJKOFF] (V. L.) and VOVK (A. M.). **Biological activity of acyl derivatives of the virus of Tobacco mosaic.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxxviii, 7, pp. 221–222, 1943.

In experiments conducted at the Institute of Microbiology, Moscow [*R.A.M.*, xxiii, p. 81], inoculations of tobacco and tomato plants with benzoylized and acetylized derivatives of tobacco mosaic virus were as successful as those with the normal virus itself, and the symptoms produced were identical in both cases. Inoculations of a new lot of tobacco and tomato plants with the juice from plants infected with the acyl derivatives were again as successful as those with the juice infected with the normal virus itself, indicating that acyl derivatives are as fully infective as the normal virus and capable of producing the same symptoms. It is assumed that within the plant into which these derivatives are introduced, the production of normal virus molecules takes place, and it is suggested in explanation of this phenomenon that the acylated molecule of the virus undergoes saponification in the living vegetable cell and hence is regenerated into its normal state.

MCKINNEY (H. H.) & CLAYTON (E. E.). **Acute and chronic symptoms in the Tobacco ring-spot disease.**—*Phytopathology*, xxxiv, 1, pp. 60–76, 4 figs., 1944.

Tobacco ring-spot virus, like tobacco yellow mosaic virus [*R.A.M.*, xxiii, p. 153], produces two phases in Samsun tobacco, namely, acute with pronounced symptoms and chronic, in which the expression of infection assumes a milder form. The two diseases represent different levels of disease expression. In the case of yellow mosaic, the level of plant resistance was so low that even in the chronic phase the reduced disease reactions were very marked, whereas in ring spot the level of resistance was so high that ring spot and mottling did not develop in the chronically infected leaves of Samsun and other varieties, including T.I.448 A and selections from this genotype, which is highly resistant to mosaic.

So strong was the resistance of Swiss Giant pansies (*Viola tricolor*) that typical ring-spot symptoms did not appear in any form, even though the virus invaded the inoculated plants. On the other hand, in the Early White Spine cucumber, the level of resistance to ring spot was sufficiently low to permit the development of mosaic mottling throughout most of the chronic phase. The virus reduced the green weight of the plants by some 97 per cent., the decrease being reflected in the smaller size of the leaves and in the shortness and slenderness of the runners. In Scotia beans local lesions were formed on the primary leaves inoculated with ring spot, systemic infection by which was more rapid at near 33° C. than at 22·5°, acute necrosis involving the secondary leaves and stem and finally destroying the entire plant at the former temperature.

Further evidence of resistance to ring spot in tobacco was afforded by the necessity of large quantities of inoculum and ideal cultural conditions to insure strong acute reactions, especially in the case of older plants, in which, moreover, chronic symptoms were erratic or absent unless an abundant supply of the virus was forced into the very young apical tissues. The level of virus synthesis in ring spot would thus appear to be relatively low, the meristematic tissue only being invaded with difficulty. Once invasion has taken place, however, the subsequent young leaves contain very few virus-free areas. As in the case of yellow mosaic [loc. cit.], the inoculation of chronically diseased leaves with the ring-spot virus did not induce the primary acute reactions resulting from the similar treatment of healthy foliage.

The data obtained in these studies are regarded as confirming already available evidence of a clear distinction between the suppression of external symptoms in chronic diseases and acquired immunity.

VALLEAU (W. D.), JOHNSON (E. M.), & DIACHUN (S.). **Tobacco leafspot bacteria on roots of pasture plants.**—Abs. in *J. Bact.*, xlvii, 2, p. 214, 1944.

Previous studies at the Kentucky Agricultural Experiment Station showed that *Bacterium* [*Pseudomonas*] *tabacum* and *Bact. angulatum* [*P. angulata*] multiply on the roots of several crop plants and weeds, and may persist over winter in this way on the roots of cover crops planted in succession to tobacco [*R.A.M.*, xxiii, pp. 59, 192]. Later investigations have demonstrated the capacity of *P. angulata* to persist on wheat and crimson clover [*Trifolium incarnatum*] roots for at least $1\frac{3}{4}$ years after tobacco harvest. Inoculations from soil cores containing roots from bluegrass [*Poa pratensis*] fields in which tobacco beds were prepared showed the bacteria to be present, presumably on the roots of certain pasture plants, before the appearance of the diseases in the plant bed. *Pseudomonas tabacum* was likewise obtained from weed roots in a field prepared for setting tobacco at the time when the latter operation was taking place.

WALLACE (J. M.) & LESLEY (J. W.). **Recovery from curly top in the Tomato in relation to strains of the virus.**—*Phytopathology*, xxxiv, 1, pp. 116–123, 1 fig., 1944.

In 1941 five, and in 1942 three virulent strains of the [sugar beet] curly-top virus were singly inoculated into Guasave-A tomato plants at the California Citrus Experiment Station, Riverside. In both years, there were some conspicuous differences in the reactions of the plants inoculated with the several strains, such variations being, in general, consistent in the two seasons. The virulence or mildness of the individual strains decisively influenced the degree of recovery among the diseased plants, those infected by strain 3, for example, being noticeably superior in recuperative capacity to those of all other groups, besides showing much less severe symptoms than those attacked by strain 9 or 58. In 1941, the percentages of plants recovering from infection by strains 3, 9, and 58 were 100, 88·6, and 80, respectively. Most of the plants inoculated with strains 5 and 75 fell into the small or moderate recovered growth classes. In 1942, recovery was again most advanced in the group of plants infected by strain 3, followed by 9 and 58, the differences between which were only slightly in favour of the former. At the same time (74 days after inoculation), the condition of the plants inoculated with a mixture of the three strains was about equal to that of the 58 group. While no conclusive explanation of the high interannual variability in the percentage of recovery of Guasave-A tomato plants observed in 1939 and 1940 is forthcoming, the above results suggest that the strain of virus, as well as environmental conditions, determine the percentage of plants recovering.

DAVIDSON (R. W.) & CAMPBELL (W. A.). **Observations on a gall of Sugar Maple.**—*Phytopathology*, xxxiv, 1, pp. 132–135, 2 figs., 1944.

Globose or fusiform galls, often bearing one or more cankers, are fairly prevalent on sugar maple (*Acer saccharum*) trunks in the Kane Experimental Forest, Pennsylvania, and the adjacent Allegheny National Forest, and have also been observed in New York and New England. The same type of excrescence is designated 'globose canker' by Lorenz and Christensen in their survey of forest tree diseases in the Lake and Central States [*R.A.M.*, xvii, p. 277]. The galls occur on trees from 2 to 18 in. in diameter at breast-height, mostly on stems 4 to 8 in. in diameter, and are nearly always found on the main trunk, 6 to 8 ft. from the ground, from one to four developing on a single maple. In the early stages, the bark covering the hypertrophied part is often smooth or only slightly furrowed, but the larger galls are usually much fissured, while dead streaks tend to develop on one or more sides; these sometimes heal over, producing elongated ridges, but the

surface seldom remains long unbroken owing to the further activity of the agent of the swelling, and the tree may gradually become girdled and die through persistent necrosis of the cambium. The greenish-black streaks in the wood underlying the galls are strongly reminiscent of those termed 'mineral stain' [ibid., xxiii, p. 201]: the dark stained wood remains very hard and heavy.

Of the various organisms isolated from the central area of discoloration, the most common were a slow-growing bacterium resembling one associated with red heart in birch and *Torula ligniperda*, another concomitant of the same disease [ibid., xx, p. 326], while a species of *Coniochaeta* and *Coryne sarcoides* were also occasionally present. None of these entities having been isolated from the advancing margin of diseased tissue, their connexion, if any, with the death of the sapwood must be indirect. The activity of the pathogenic agency continues in narrow stripes, on both sides of which dead areas have developed in the cambium. Leaving aside the question of its identity, the causal organism of the galls appears to gain ingress to the stem at an early stage in the life of the tree, to work slowly outwards through the living sapwood, and gradually to encroach to within a few or even 1 mm. of the cambium, with a resultant stimulation to growth at that point.

Gall-bearing trees are not promising subjects for timber production, and may be used as cuttings for chemical or fuel wood. The gall-forming organism is obviously not of a highly virulent order, since the numerical increase of affected trees in a stand takes place at a very slow rate.

GRAVES (A. H.). **Chestnut breeding work in 1943.**—*Rep. Brooklyn bot. Gdn, 1943* (*Brooklyn bot. Gdn Rec.*, xxxiii, 1), pp. 11–13, 1944.

The work of interhybridization among indigenous chestnuts and back-crossing the resultant progeny with selected Japanese and Chinese individuals with a view to the development of a tall timber type possessing immunity from blight [*Endothia parasitica*] proceeded along the usual lines in 1943 [cf. *R.A.M.*, xxii, p. 411]. The F_1 hybrids were maintained in a vigorous condition by inarching the basal shoots, thereby bridging over the lesions inflicted by the fungus. Since nearly all the grafts made by this method in 1943 were successful, a good supply of suitable breeding stock is available. Inoculation experiments are in progress to determine the reactions of the hybrids to *E. parasitica*.

HUBERT (E. E.). **The curl test. Method for rapidly determining water repellancy of preservatives in wood.**—*Timberman*, xliv, 10, pp. 42, 44, 1 fig., 1943.

An instrument has been constructed for the rapid determination of water repellancy in wood preservatives by measuring the degree of curl produced through the partial immersion of cross-section strips of treated and untreated ponderosa pine in water at 70° F. for stated periods. Using this procedure, tests may be completed in days instead of the weeks required to obtain comparable results by the National Door Association's approved technique.

FINDLAY (W. P. K.). **Wood tar as a preservative for timber.**—*Emp. For. J.*, xx, 2, pp. 151–153, 1943.

Agar tests carried out at the Forest Products Research Laboratory, [Princes Risborough], showed wood tars (from the Gold Coast, Nigeria, England, America) to be highly toxic to *Fomes annosus*, *Lentinus lepideus*, *Coniophora cerebella* [*C. puteana*], and *Polystictus versicolor*. In wood-block tests, in which small blocks of pine sapwood and of beech impregnated with the various tars were exposed for three months to attack by *L. lepideus*, *C. puteana*, *Poria vaporaria*, and *Polystictus versicolor* under controlled conditions, wood tars were found to vary considerably in their toxicity, some being equal to coal tar creosote, but others much less toxic. It is considered, however, that even the least toxic among them would be sufficiently

effective as a wood preservative provided that good penetration could be obtained with it. The disadvantages of these tars lie in their extreme viscosity and the high tar acid content responsible for their corrosive nature. It is suggested that in tropical countries where no local supply of coal tar creosote is available, wood tar could be usefully utilized for the preservation of timber. As the composition of wood tars is highly variable, depending largely on the kind of timbers from which they are derived and other factors, the problem of how to use them to the best advantage can only be solved locally.

Cass-Smith (W. P.). **Black rot of Cabbage, Cauliflower, and related plants.** *J. Dep. Agric. W. Aust.*, Ser. 2, xx, 4, pp. 298–302, 4 figs., 1943.

Black rot (*Bacterium campestre*) [*Xanthomonas campestris*] occurs in Western Australia chiefly on cabbage and cauliflower, but it also attacks Brussels sprouts, broccoli, kohlrabi, turnip, swede, radish, flowering stock [*Matthiola incana*: *R.A.M.*, xxi, p. 291], and certain wild weeds, including mustard and wild radish. The disease is usually of small consequence in winter, but in warm, wet weather it may prove highly destructive, especially if it becomes established early in the growing season.

In March, April, and May, 1943, weather conditions favoured attack, and outbreaks occurred on cabbages in several areas, including Osborne Park, Spearwood, Balcatta, and Wanneroo. Serious losses were sustained, in some cases amounting to total crop failure. These outbreaks were largely attributed to the planting of contaminated seed, and there is no doubt that if growers had troubled to make use of simple control measures, the disastrous losses incurred could, to a great extent, have been prevented.

Unless the seed is known to be clean it should be submitted to hot-water treatment [ibid., xix, p. 250]. Seed-beds should be remote from the area where the transplants are to be set, and should be made on new soil or on land that has not grown cruciferous crops for several years. If necessary, the soil should be treated with formalin. Weed hosts should be eliminated from the vicinity. Care must be taken to avoid wetting the foliage in the seed-bed: planting should be carried out in moist soil, or furrow-irrigation should be adopted. Crucifers should be grown only once every two or three years in the same ground. Biting insects should be kept down, and all plant refuse burnt or buried in land that is not to be planted to crucifers for two or three years.

Green (D. E.) & Ashworth (D[orothy]). **Club root of Brassicas—control test II.**—*J.R. hort. Soc.*, lxix, 5, pp. 144–147, 1944.

In a further test at the Royal Horticultural Society's Gardens, Wisley, Surrey, in 1943 on the applicability of various chemicals to the control of club root (*Plasmodiophora brassicae*) [*R.A.M.*, xxii, p. 283] on spring-sown Primo, Winnigstadt, and Christmas Drumhead cabbages, Early White Stone turnips, and French Breakfast radishes, highly satisfactory results were again given by 4 per cent. calomel [mercurous chloride] dust raked into the soil at the rate of 1½ oz. per sq. yd., as well as by the proprietary substances A (containing calomel) and B, all of which appear to exert an effect persisting over more than one season. As temporary palliatives of the disease these preparations appear to be more efficient than lime or mercuric chloride, though for long-range treatments liming and proper cultural methods are probably superior. Mention may be made of the complete freedom from infection of the turnips in all three samplings (at 5, 9, and 12 weeks after sowing), as possibly indicative of high resistance in the test variety.

Carsner (E.). **The Sugar Beet in Europe and America.** *J. N.Y. bot. Gdn.* xlv, 530, pp. 25–30, 3 figs., 1944.

In connexion with a brief survey of the history of sugar beet cultivation in

Europe, where the foundation was laid by A. S. Marggraf, of the Prussian Royal Academy of Science in 1747, and the United States, where preliminary investigations were instituted in 1836, the writer cites some figures illustrative of the virulence of curly top. Since 1898, devastating epidemics of the disease at frequent intervals have swept through some of the factory districts of California, Utah, Colorado, Idaho, Oregon, and Washington. In 1934, for instance, 88 per cent. of the area under beets (18,635 out of 21,389 acres) in the Twin Falls region of Idaho was abandoned largely on this account, and the yield from the remaining fields averaged only 4·88 tons per acre, compared with 13·78 from 25,612 acres in 1933, a mild curly-top year. In 1941 the yields from the curly top-resistant varieties, U.S.1, U.S.33, U.S.12, U.S.22, and Improved U.S.22 [*R.A.M.*, xxiii, p. 159] amounted to 6·31, 8·40, 11·25, 14·32, and 16·61 tons per acre, respectively, whereas Old Type (European) produced no marketable beets.

Reid (W. D.). **The resistance of Beans against Bean-wilt and anthracnose, and notes on occurrence of Bean mosaic.** –*N.Z. J. Sci. Tech.*, A, xxv, 3, pp. 125-128, 1943.

Of 34 bean varieties tested by the Plant Diseases Division at Palmerston North and Auckland from 1937 to 1942, two, Hamburger Market and Ousara, were free from wilt (*Pseudomonas medicaginis*) [*R.A.M.*, xiv, p. 140], six from anthracnose (*Colletotrichum lindemuthianum*), viz., Early White, Ne Plus Ultra, Northern Star, Idaho, W.S., and Wisconsin, and nine from mosaic, i.e., Blue Pod, Bush, Case Knife, Erecta, G.150, Refugee Idaho, Refugee Wisconsin, Unrivalled, and Zulu King. Of the ten varieties included for one or two seasons only, Epicure, Sydney Wonder, and White Dutch were immune from *P. medicaginis*, Brown Wonder, Epicure, Hodson's Long Pod, Kentucky Wonder, Startler Wax, Stringless Green Pod, Sydney Wonder, and White Dutch from *C. lindemuthianum*, and all except Kentucky Wonder (trace) and Stringless Green Pod (1 per cent.) from mosaic. In the six-year series of tests, the average infection by wilt, anthracnose, and mosaic ranged from a trace to 30, a trace to 55, and a trace to 45 per cent., respectively. Three varieties sustained very heavy damage from mosaic, namely, Dubbele or Doppelte, Perfect, and Zucker Perl.

Reichert (I.), Palti (J.), & Kapuler (B.). **Trials for the control of diseases of Vegetable Marrows. (First Report).**—*Bull. Rehovoth agric. Exp. Sta.* 33, 30+x pp., 4 figs., 1943. [Hebrew, with abbreviated English translation.]

The chief diseases affecting vegetable marrows in Palestine are powdery mildew (*Erysiphe cichoracearum*), blossom-end rot (*Pythium ultimum*), fruit rot (*Sclerotinia sclerotiorum*), leaf stalk rot, usually due to the last-named fungus, but sometimes caused by *S. minor*, and black mould (*Rhizopus nigricans*) [*R. stolonifer*].

In spraying and dusting experiments on autumn-grown vegetable marrows in the central coastal plain, powdery mildew was effectively controlled by yellow flowers of sulphur and Gaza sulphur (Superfine and Extra Fine grades), and by spraying with sulfinette 1½ per cent., while sulfocide ½ per cent. and the Standard grade of Gaza sulphur were weaker in action. The addition of lime to Gaza sulphur Extra Fine grade seriously impaired its effectiveness against mildew. Weekly applications of sulphur gave much better results than fortnightly ones, and the effects were even more striking when the applications were made at intervals of four to six days. These treatments increased productivity by 75 to 100 per cent. or more, and in two out of three tests considerably extended the duration of the picking period. Yellow sulphur partly controlled *Sclerotinia* leaf stalk rot, while Gaza sulphur and lime mixed, and sulfocide spray were less effective. The incidence of blossom-end rot was greatly reduced by sulphur treatment (especially by

yellow sulphur) in one experiment, though in a second test these and other sulphur treatments failed to control the disease.

In one test, copper treatments with bordinette $\frac{2}{3}$ per cent., perenox $\frac{1}{3}$ per cent., and Bordeaux mixture 1 per cent. reduced the incidence of powdery mildew effectively, but gave less control of leaf-stalk rot and blossom end rot than the sulphur treatments. The copper treatments gave lower yields than the sulphur treatments, possibly because they had an adverse effect on the leaves.

Wastefully heavy rates of application were found necessary in the case of the pure Gaza sulphurs of the Standard and Extra Fine grades, as these emerge from the duster in streamlets instead of forming clouds of dust. The addition of lime weakened the fungicidal effect of the sulphur to such an extent that these grades cannot be recommended until suitable fillers are found. On the other hand, the Superfine grade of Gaza sulphur was even more economical than yellow sulphur, and appears to equal the latter in every way.

The material outlay involved in ten applications of sulphur dust at 10 kg. per 1,000 sq. m. per application and of sulfinette $1\frac{1}{2}$ per cent., 200 l. per 1,000 sq. m. per application, i.e., of 100 kg. sulphur and of 30 l. sulfinette, is about the same. As dusting requires only about half the amount of labour that would be employed in spraying, dusting is the cheaper method.

The results obtained in these experiments justify the assumption that treatment may increase the yield by 70 to 100 per cent. On a basis of the yields obtained in the tests, this additional yield represents an increase in the gross income from 1,000 sq. m. of about 10£P., while the total expense incurred will not exceed 4£P. per 1,000 sq. m.

Mujica (F.). **La septoriosis del Apio en Chile.** [Celery septoriosis in Chile.] *Bol. Sanid. veg., Santiago*, ii, 2, pp. 140–143, 1942.

Celery blight (*Septoria apii-graveolentis*) is stated to be responsible for immense annual losses to growers in Chile, where it is the most destructive disease of the crop. The mean dimensions of the conidia on three specimens of celery and one of *Apium nodiflorum* ranged from 34·6 to 42 by 1·8 to 2·4 μ. Of the three methods of seed disinfection variously recommended, viz., 30 minutes' immersion in mercuric chloride 1 in 1,000, the same period in hot water (48° to 49° C.), and 15 minutes in formalin 4 in 1,000, the last-named is the least injurious to the seed, though somewhat less effective than the others. Bordeaux mixture (1 per cent.) should be applied at 10- to 15-day intervals from the emergence of the seedlings until their transplantation to their final quarters.

Kligman (A. M.). **Some cultural and genetic problems in the cultivation of the Mushroom, Agaricus campestris Fr.** *Amer. J. Bot.*, xxx, 10, pp. 745–763, 7 figs., 1943.

The author proposes the trinomial *Agaricus campestris bisporus* for the cultivated mushroom to mark its physiological and morphological distinctness from the wild four-spored *A. campestris*. The tip cells of the growing mycelium were found to contain 7 to 25 nuclei, there being no diminution in number as the mycelium grows. The nuclei in tip cells divided independently, not simultaneously; they were distributed at random, and showed no disposition to pair. It is concluded that conjugate nuclear division does not occur in *A. campestris bisporus*. In the wild *A. campestris* fundamentally similar nuclear phenomena were observed. The cultivated mushroom is regarded as homothallic even though its nuclear behaviour is unlike that of other homothallic Hymenomycetes. Since monosporous mycelia produce perfectly normal sporophores, heterothallism is inadmissible. Monosporous isolates of the cultivated mushroom exhibited wide differences in rate of growth, cultural appearance, physiological activity, and productivity. From 20

to 30 per cent. of monosporous mycelia were sterile; such mycelia being usually atypical in mycelial characters. Multisporous cultures were never sterile: all hyphal tips cut off from a very young multisporous mycelium were found to be fertile.

In a small number of cases, sporophores were produced when sterile races were paired. Owing to the manner in which the mycelia interacted with each other, successful crosses were apparently not due to the pairing of uni-sexual strains, and no evidence was found to indicate the existence of such strains. An analysis of nuclear division in the tip cells indicated that sister nuclei are apparently not prohibited from lying in the same cell so that the two nuclei which fuse in the basidium are probably not of opposite sex. It is suggested that *A. campestris bisporus* as well as other homothallic Hymenomycetes might possibly be non-sexual.

Sectors were very commonly observed in mycelia of the white form of the cultivated mushroom, but never in the brown one. All those which had appeared were similar in cultural appearance and are termed the 'fluffy' as distinct from the normal 'appressed' type of mycelium. The fluffy type readily reverted to the normal. The appearance of sectors was not associated with observable changes in genetic constitution and hence these are not regarded as true mutants.

Mycelia derived from pieces of tissue were just as stable as those derived from spores. Cultures of *A. campestris bisporus* could apparently be indefinitely sub-cultured without 'running-out' or degenerating. Ageing of the mycelium does not, within limits, result in variation. Strains of the species are not fundamentally altered by the particular type of spawn substrate on which they are grown. Mutations affecting the morphology and colour of the sporophores are for the most part stable and can be propagated by monosporous, multisporous, and the tissue culture methods. Factors governing the colour of the sporophores appear to be particularly mutable. Random pairing of sterile mycelia of the brown and white forms of the cultivated mushroom resulted in the production of sporophores in a few instances but no evidence was obtained indicating that such sporophores were hybrids. When a mixture of spores of the brown and white forms were germinated, hybrids could not be detected among the sporophores produced by the mixed mycelium. It would appear that selection among monosporous mycelia offers the greatest opportunity for isolating new strains. Mycelia derived by the multisporous method or by the tissue culture technique do not usually exhibit variations from the parent.

Hadorn (C.). **Weitere vergleichende Versuche im Jahre 1943 über Kupfersparmöglichkeiten im Weinbau.** [Further comparative experiments in the year 1943 on copper-saving possibilities in viticulture.]—*Schweiz. Z. Obst- u. Weinb.*, liii, 6, pp. 100–128, 1 fig., 5 graphs, 1944.

Continuing his experiments at the Wädenswil (Zürich) Research Station in connexion with copper-saving treatments for the control of vine downy mildew (*Peronospora*) [*Plasmopara viticola*: *R.A.M.*, xxii, p. 341], the writer makes the following observations and recommendations. The quantities of copper allotted by the authorities for agricultural purposes in 1943 [ibid., xxi, p. 497] were experimentally shown at Lausanne [ibid., xxii, p. 91] and Wädenswil to be generally adequate. Trials at the latter Station of 39 fungicides revealed no further practical possibilities of economy in copper consumption, except in the case of copper oxychloride Rohner A, a product manufactured by Rohner A 9, Pratteln, exclusively from salvaged waste material which gave highly satisfactory results at a concentration of 0·75 per cent. It is estimated that every ton of the new copper oxychloride used spares 320 kg. metallic copper of the existing war reserve. The summer of 1943 was a dry one, and in rainy seasons the dosage may have to be

slightly increased. Rohner A has also proved its worth in the orchard and vegetable garden. However, pending a final decision as to the place of the new copper oxychloride in the spraying campaign, red copper Sandoz (0·3 or 0·5 per cent.) is the only 'economy' preparation to be unreservedly recommended.

Promise of interesting future developments was given by 1·5 per cent. Siegfried II A and II B combined copper salts containing only 8·4 per cent. metallic copper (AG. vorm. B. Siegfried, Zofingen), and the Fundal spray (Reb-Fundal) and dust (Staub-Fundal), copper-free preparations supplied by Schering AG., Berlin.

Stanley (W. M.). **Chemical properties of viruses.** *Rep. Smithson. Instn., 1942*, pp. 261–272, 6 pl., 1943.

This paper is reprinted from *Sci. Mon., N.Y.* [*R.A.M.*, xxi, p. 49].

Stanley (W. M.). **Soviet studies on viruses.** *Science*, N.S., xcix, 2564, pp. 136–138, 1944.

In this address to the Science Panel of the Congress of American-Soviet Friendship, New York, 1943, the author surveys the achievements of Russian science in the field of virus study, from Iwanowski's famous filtration experiment described by him in 1892 to the recent researches in plant and medical virology by Rischkov [Ryjkoff], Goldin, Soukhov [Soukhoff], Vovk, Gromyko, and others. The author regards Iwanowski as having the same relationship to the study of viruses as Pasteur and Koch are commonly regarded as having to that of bacteriology.

Fifty-fifth Annual Report of Purdue University Agricultural Experiment Station, Lafayette, Indiana, for the year ending June 30, 1942.—108 pp., 10 figs., 1 graph, 1942.

The following are among the items of phytopathological interest occurring in this report [cf. *R.A.M.*, xix, p. 7]. C. L. Burkholder, T. E. Heinton, and S. A. Anderson state that at the Moses Fell Annex Farm orchard at Bedford, Indiana, where over 167,000 gals. spray were applied in 1941, a stationary spray-pumping plant controlled diseases and insects at a smaller outlay than a portable apparatus. The average cost per 100 gals. amounted to 44 cents in 1941, and 42 cents in 1935–39, while the lowest yearly cost of portable spraying amounted to 70 cents per 100 gals. In a commercial orchard near Vincennes, Indiana, where a stationary plant capable of servicing 12 to 14 gunmen and over 1,000,000 gals. material per year was used, the average cost per 100 gals. for the ten-year period 1931–41 was 25·7 cents, while in 1941 the figure was 19 cents, which is lower than any spray cost figures published.

P. R. Elliker, W. H. Brown, and B. E. Horrall state that stirring mould-contaminated cream twice daily retards mould growth but encourages that of yeasts. Addition of fresh cream by layering it over the stored cream results in less growth than where cream is poured into the container without layering. Mould-contaminated cream results in mouldy butter, at least 50 per cent. of the mould content of the cream being carried over in the churning. Stirring retards mould growth because the moulds are removed from the top surface of the cream during the process and put down in the lower layers, where there is less oxygen. *Oospora lactis*, the mould organism most often found in cream [ibid., xxi, p. 16], actively utilizes the lactic acid in milk when the nitrogenous and other requirements of the fungus are met. Sour cream thus provides an excellent source of energy in the form of lactic acid for these moulds.

G. H. Cutler states that the new soft winter wheat variety Fairfield, developed in Indiana, is superior to all the common soft winter wheat varieties at present grown in the State. It combines the good milling and baking qualities and the loose smut [*Ustilago tritici*] and mosaic resistance of Fulhio with the high yield,

high resistance to winter-killing, and the excellent suitability for combine-harvesting of Purkof.

Inoculation studies by A. J. Ullstrup showed that a spore suspension of *Diplodia* [*zeae*] can easily be applied to the ears of dent maize by means of a pressure sprayer. In this way, a great deal of material can be tested with a minimum of labour. The best time for applying the inoculum appears to be between the full-silk and the roasting-ear stages. The ears become more resistant as they approach maturity.

Preliminary results by S. O. Thomas, J. A. McClintock, and C. L. Porter in work on the control of rose virus diseases showed that the critical temperature for roses is 52° C. As much as 85 per cent. of the material submitted to this temperature for periods ranging up to five minutes survived. Susceptible host plants inoculated with diseased material which was treated at 52° failed to show virus symptoms.

Five of eight fungicides tested by R. C. Baines, N. K. Ellis, and L. J. Swift effectively controlled anthracnose [*Sphaceloma menthae*: ibid., xvii, p. 485] of row peppermint [*Mentha* spp.]. The treatments did not affect the chemical or physical properties of the oil obtained from the treated plants.

Tests by R. C. Baines indicated that dinitro-cresol [elgetol] eradicant spray materials applied to fallen leaves are of only limited value against apple scab [*Venturia inaequalis*] in Indiana.

Working with oats, lucerne, and tobacco, H. E. Jones and J. D. Scarseth found that a high calcium content in the soil tends to decrease boron availability [ibid., xxi, p. 43; xxiii, p. 277]. Since the calcium content of the plant is a direct function of that in the soil, the relationship between calcium and boron [in the plant] expressed as a ratio should indicate whether the amount of boron in the soil is deficient, optimum, or toxic. It was ascertained that oats grown on an acid soil to which borax was added at the rate of 25 lb. per acre developed toxicity symptoms, though lucerne and tobacco withstood 50 and 100 lb. per acre, respectively, on limed soils. A range of 20 to 180 p.p.m. boron was found in tobacco, 25 to 180 in lucerne, and 15 to over 400 in oats.

Martin (J. P.). **Pathology.** *Rep. Hawaii Sug. Exp. Sta., 1942-3* (ex *Printed Reps. Hawaii Sug. Pl. Ass., 1943*), pp. 19–28, 1944.

In this report [*R.A.M.*, xxii, p. 343] it is stated that according to information received from A. F. Bell the Hawaiian sugar-cane varieties 28-4291, 31-2484, and 32-8560 are, under Australian conditions, resistant to downy mildew [*Sclerospora sacchari*: ibid., xxii, pp. 149, 276], while 31-1389 is highly susceptible; 28-4291, 31-1389, 31-2484, 31-2806, 32-1063, and 32-8560 are resistant to gumming disease [*Xanthomonas vasculorum*: loc. cit.], while 32-3575 is susceptible; and 28-4291, 31–2484, 31–2806, and 32–8560 are highly susceptible to Fiji disease [loc. cit.], while 31–1389 is moderately so.

C. W. Carpenter states that brown stripe (*Cochliobolus stenospilus*) [ibid., xxi, p. 349] is still of major importance in localized areas, though incidence has been much lower during the past two years. Chlorotic streak [ibid., xxii, p. 344] is much more severe in poorly drained areas and regions of high rainfall than elsewhere. The best control measures are the selection of healthy planting material and the hot-water treatment of diseased or doubtful planting material. Field losses from eye spot [*Helminthosporium sacchari*: loc. cit.] were the lowest for many years, largely owing to the wide use of resistant varieties. Leaf scald [*X. albilineans*] was recorded on 32-8560 for the first time, but the evidence still indicates that this variety is highly resistant. In the fields, mosaic was of minor importance, the planting of resistant varieties having reduced the disease to a minimum. When Lahaina, H.109, and 32-8560 sugar-cane seedlings were grown in pots given 60 gm. sodium nitrate (equivalent to about 900 lb. nitrogen per acre), *Pythium* root rot [*P. graminicola*] became very severe on Lahaina, though in the control pot not

given the fertilizer treatment none was present. The growth of H.109 was better in the fertilized than in the untreated soil, though a moderate amount of root-rot was present. In 32-8560 root rot was not identified, but growth appeared depressed in the treated soil.

C. W. Carpenter states that tomato tip blight [ibid., xxii, p. 502] is very probably responsible for losses in Hawaii previously attributed to spotted wilt. Under field conditions, both young and mature tomato plants became severely defoliated as a result of infection by grey leaf spot (*Stemphylium solani*) [ibid., xxii, pp. 54, 81, 116]. Young plants of the Bounty, Pritchard, and Marglobe varieties grown under moist conditions were sprayed with a suspension of the fungus in water; the first symptoms of the disease became apparent at the end of the second day. Bounty was most severely affected, and Marglobe was slightly more resistant than Pritchard.

Gall-like blisters ('oedema') were observed on cabbage seedlings and plants. The abnormality is attributed to want of balance between water absorption and transpiration. The excessive pressure produced in certain thin-walled leaf cells results in a localized overgrowth and a bulging of the leaf surface. These bulges usually rupture and become dry and corky.

Diseases of truck crops studied included *Cercospora beticola* on beet, *C. apii* var. *carotae* on carrot, *Septoria consimilis* on lettuce [? *Lactuca scariola*], *Phytomonas viridilivida* on lettuce, *Mycosphaerella berkeleyii* [*C. personata*] on groundnut, *Piricularia oryzae* on rice, and *Pseudomonas glycines* on soy-bean.

Verslagen Proefstations. [Experiment Station Reports.] *Versl. Landb. Syncl., Batavia, 1940*, pp. 154–282, 1941.

These Dutch East Indian experiment station reports contain, *inter alia*, the following items of phytopathological interest. *Hevea* rubber plants in sand cultures deprived of nitrogen, phosphorus, or sulphur were drastically reduced both in height and girth, a shortage of these elements being manifested earlier than that of potassium, calcium, or magnesium. Nitrogen deficiency is expressed by a uniform chlorosis of the leaves, which are of a somewhat stiff growth habit, whereas in the case of lack of sulphur, the yellow coloration is more mottled. An abnormally dark green, later orange-red tinge is characteristic of an insufficiency of phosphorus. Interveinal chlorosis is the typical feature of magnesium starvation, while inadequate supplies of potassium and calcium result in marginal spotting of the leaves, accompanied in the case of the former element by desiccation.

Generally speaking, the white root-rot fungus (*Fomes lignosus*) predominates in young rubber plantations (up to the age of six or seven years) in West Java [cf. *R.A.M.*, xxi, p. 323], and the agent of red root rot (*Ganoderma pseudoferreum*) in older ones, but in 1940 the former organism was shown to be responsible for large gaps even in long-established gardens. In such cases, a year or more before the undertaking of clearing operations, decayed wood and root debris should be removed and the immediately surrounding trees eradicated, thereby affording an opportunity for the sanitation of the focus of infection. The root-collars of the neighbouring healthy trees should be exposed to prevent the spread of both pathogens [ibid., xvi, p. 634]. In young plantings over a wide clearing the extension of *F. lignosus* was assisted by the presence of *Tephrosia* between the rows of rubber [loc. cit.]. The first indication of white root rot on seedlings in the Lampongs was frequently observed in grooves on the stems. Under favourable conditions the trees may completely overcome the effects of the disease. At the Besoeki (Java) Experiment Station, *F. lignosus* severely attacked rubber in a cleared area, and was also found on *Desmodium gyroides*, *Leucaena glauca*, and coffee.

Mildew [*Oidium heveae*] occurred in an unusual form in the inflorescences and on the young leaves of rubber, being accompanied in the former organs by the larvae

of the ladybird, *Thea cineta*, which feeds on the fungus. The violent outbreaks of the disease in a number of plantations may have been connected with the abnormal drought.

On an estate where brown bast was very troublesome, the incidence of the disease was reduced, without impairing latex production, by the adoption of the 'change-over' tapping system (based on modifications in the relative positions of the cuts), as officially practised and recommended by the experiment station authorities [ibid., i, p. 265].

Effective control of stripe canker [*Phytophthora palmivora*] in the Lampongs was obtained by weekly applications of socony product 2295 A plus 5 per cent. carbolineum plantarium [ibid., xviii, p. 579; xxi, p. 323], which was also useful in the protection of the wounds inflicted in the excision of bark infected by pink disease [*Corticium salmonicolor*].

In old rubber plantations on a mountain estate under the supervision of the Central and East Java Experiment Station, severe damage was caused by black root rot (*Rosellinia bunodes*) on the *Centrosema* [? *pubescens*] cover crop, which died off over wide areas during the dry spell. From another estate, where similar trouble had been experienced in connexion with *Xylaria thwaitesii*, favourable reports were received concerning the replacement of *C.* (?) *pubescens* by Lima bean (*Phaseolus lunatus*). The same measure was successfully adopted in the case under review, the Lima bean crop flourishing in spite of the presence of brown, sunken spots on the stem bases, which in laboratory inoculation tests bore a profusion of perithecia and coremia.

Investigations on the possibilities of combating red root rot of tea (*G. pseudoferreum*) on a Buitenzorg estate [ibid., xviii, p. 579] led to the following conclusions. *Albizzia* [*falcata*] is of great importance in the transmission of infection. Dead and dying bushes should be eradicated and removed, together with any other infective material, as rapidly and completely as possible. The so-called 'isolation trenches' do not entirely arrest the spread of the pathogen. Gaps in the stand arising through the action of the red root-rot fungus should be deeply excavated and all woody remnants cleared away during the interval before replanting.

On one tea estate, a high proportion of the bushes were found to have been killed, not by *G. pseudoferreum*, but by *Ustulina* [*zonata*], which predominated, together with *Diplodia* [*Botryodiplodia theobromae*: loc. cit.], particularly among isolated cases in the midst of healthy bushes. *Poria hypolateritia* was prevalent on some plantations in southern Sumatra. Following the prolonged rains in the early part of the season, *Cercosporella theae* developed in certain gardens. This fungus consistently originates on *Acacia decurrens*, and after completely defoliating it, passes on to tea.

Many complaints were received from Sumatra concerning the damage inflicted on *Cinchona ledgeriana* [*C. calisaya* var. *ledgeriana*] by stripe canker [*Phytophthora palmivora*], investigations on which showed that new seed-beds were commonly laid down on the site of those just cleared of the same crop. This failure to practise crop rotation was likewise reflected in the mature stands. An effective method of control was found to consist in the excision of the diseased tissue right down to the wood and the application to the wound (which should taper to a point to assist in healing over) of socony grease plus 5 per cent. carbolineum.

Coffee branches infected by top die-back in Central and East Java [ibid., xix, p. 341] yielded the parasitic *Colletotrichum coffeanum* [*Glomerella cingulata*] in abundance, the organism ordinarily associated with the disease [*Rhizoctonia*] being only sporadic. Drastic pruning proved superior to more conservative methods in the control of top die-back. Pliofilm [ibid., xxi, p. 331] effectively protected inoculation wounds on coffee plants from desiccation, cellophane being useless for the purpose.

A species of *Corticium*, distinct from *C. gardeniae* or any other member of the genus hitherto found on coffee, occurred on Java coffee hybrids at the Besoeki Experiment Station, one phase being represented by a very delicate, cobweb-like mycelium overrunning the under sides of the leaves and the berries, which subsequently produces a white, powdery layer of typical fructifications, and another by dark brown, necrotic spots, permeated by a characteristic *Rhizoctonia* mycelium extending over the green areas and giving rise to pseudosclerotia [ibid., xii, p. 760]. The infected leaves finally die and turn brown, but being firmly joined to the neighbouring healthy ones by the above-mentioned mycelium, they mostly remain hanging on the bushes. Cultures from the *C.* stage, the pseudosclerotia, and the brown spots without fructifications all yielded a typical *R.* mycelium, accompanied in some isolations by pseudosclerotia.

Halperin (L.) & Spaini (Lydia S.). **Tres bacteriosis existentes en la Argentina.** [Three bacterioses existing in Argentina.]—*Rev. argent. Agron.*, vi, 4, pp. 261-275, 2 pl., 1939. [English summary. Received June, 1944.]

Descriptions are given of the symptoms and etiological agents of three bacterial diseases occurring in Argentina, viz., soft rot of cabbage and chilli (*Erwinia carotovora*), black rot of cabbage (*Phytomonas* [*Xanthomonas*] *campestris*), and bacterial spot of tomato (*P.* [*X.*] *vesicatoria*), together with notes on their host ranges, geographical distribution, mode of dissemination, economic importance, and control. *E. carotovora* has been observed on cabbage in the provinces of Buenos Aires, Santa Fe, Entre Rios, and Salta, and on chilli in Salta and Jujuy, *X. campestris* in Buenos Aires, Santa Fe, and Entre Rios, and *X. vesicatoria* in Buenos Aires. *E. carotovora* is responsible for heavy damage to its hosts, causing the total failure of the chilli crop, whereas *X. campestris* is chiefly important as paving the way for the infection of cabbage by the soft-rot organism.

Cherewick (W. J.). **Studies on the biology of Erysiphe graminis DC.** –*Canad. J. Res.*, Sect. C, xxii, 2, pp. 52–86, 1 pl., 1944.

Erysiphe graminis is reported to occur in all parts of Canada [*R.A.M.*, xxii, p. 155], even as far north as 65 miles north of the Arctic circle, but to be most prevalent in British Columbia and the five eastern provinces. In the Prairie Provinces, where epidemics are rare, infection up to 85 per cent. has been observed. So far, *E. graminis* was found on all the common cereals in Canada and also on *Agropyron* spp., *Beckmannia syzigachne*, *Bromus* spp., *Dactylis glomerata*, *Hordeum jubatum*, *Phleum pratense*, and *Poa* spp.

Experimental evidence obtained in Manitoba during 1941 and 1942 indicates that *E. graminis* most usually overwinters in mycelial mats on dead straw or as mycelial infections on volunteer or winter grain plants and on perennial grasses; it only occasionally overwinters to some extent in the perithecial stage [cf. ibid., xxii, p. 165].

Three new races of *E. g. hordei*, namely, 8, 9, and 10, were isolated in 1941, bringing the total of races found in Canada to seven. For the differentiation of the new races it was necessary to add Chevron to the five test varieties of barley commonly used. A number of collections of wheat mildew from British Columbia, Manitoba, and Ontario yielded only race 1 of *E. g. tritici*. *E. g. avenae* on oats is known to occur in eastern Canada and British Columbia. Studies with the various races of *E. g. hordei* from barley showed them to be stable under different environmental conditions; they are considered to be distinct biologic entities comparable to physiologic races of the cereal rusts. Results obtained from hundreds of cross-inoculations furnished no evidence that any variety of *E. graminis*, except possibly *E. g. agropyri*, can produce infection in immune varieties of its own host, or on the host of another variety, even if such hosts are injured. Germination of the conidia

of *E. graminis*, and penetration up to the papilla stage, were found to occur on the naturally immune hosts as on the susceptible ones. Two distinct types of host resistance were observed: in some hosts it manifests itself by the death of the infected cells, and in others by the distortion of the haustoria. Of the 29 single-spore cultures of *E. g. hordei* and 4 of *E. g. tritici* grown in isolated compartments or booths, 26 and 1, respectively, produced perithecia within from four to six weeks. On several occasions where mono-ascospore cultures were made from these perithecia, a pure race of the respective parent culture was obtained in each case. It is concluded that at least certain varieties and races of *E. graminis* are homothallic. On the other hand, conidial collections of barley mildew made during two seasons from experimental field plots yielded only races 4 and 6, while collections of perithecia from the same plots yielded races 4, 6, 9, and 10, indicating that recombination and segregation of factors may occur in perithecia developed in the field.

Field and greenhouse studies on the effect of environment upon the powdery mildew indicated that temperature is an important factor in mildew epiphytotics, while light has only an indirect effect, acting through the host plant, poor light rendering the nutritional conditions unfavourable to the organism. The conidia were shown incapable of surviving storage for any length of time at temperatures above the freezing point; they either germinated or died. Germination occurred readily at from 0° to 35° with an optimum at 10° C. Both the infection and the development of the disease was best at from 15° to 20°, alternating temperatures being most favourable to both the spread of mildew and the development of perithecia. Alternate drying and wetting of perithecia were necessary to induce ascospore formation, but other stages were favoured by relatively dry conditions. Conidia germinated quite well even at zero humidity [ibid., xvi, p. 104]. The percentage of infection was consistently reduced by sprinkling infected seedlings with water [ibid., xviii, p. 465], but the exact reason for this was not determined. In the light of the results obtained, it is concluded that the main function of perithecia in this species is to carry the organism over hot periods in the late summer rather than to serve as the overwintering stage. The addition to the soil of certain fertilizers and chemicals commonly claimed to increase host resistance to powdery mildew failed to increase the resistance of susceptible seedlings of wheat and barley.

Vitoria (E. R.). **El desarrollo de Fusarium avenaceum influido por el filtrado del substrato de Penicillium sp.** [The development of *Fusarium avenaceum* influenced by the filtrate of the substratum of *Penicillium* sp.]—*Rev. argent. Agron.*, vi, 4, pp. 309–314, 2 figs., 1939. [Received June, 1944.]

Fusarium avenaceum (strain 249 of the Argentine Ministry of Agriculture's collection from an unspecified host) [*R.A.M.*, xx, p. 235; xxi, p. 12], which made no growth in the author's experiments on a plain Coons's liquid medium, developed abundantly on the same substratum with the addition of filtrates of two undetermined species of *Penicillium* and *P. gladioli*, also grown on Coons's medium. The growth substances contained in the filtrates appear to act quantitatively at first, but this relationship is not maintained after 48 hours, the amounts of mycelium of *F. avenaceum* produced in a fortnight by cultures enriched with 50, 1, and $\frac{1}{4}$ c.c. of the *Penicillium* liquid being 150, 22, and 44 mg., respectively. The stimulatory effect of the *P.* filtrates evidently resides in the growth substances themselves, since no indication of the secretion of thermolabile enzymes was forthcoming.

Atkins (J. M.) & Quinby (R.). **'Comanche', disease-resistant Wheat, for planters of the plains.**—*Sth. Seedsm.*, vi, 11, pp. 17, 44, 1943.

A new hard red winter wheat variety, Comanche, resistant to the four known physiologic races of bunt [*Tilletia caries* and *T. foetida*] and leaf [brown] rust

[*Puccinia triticina*], and frequently escaping severe damage from stem rust [*P. graminis*] through its early maturity [*R.A.M.*, xxiii, p. 295], is now available for general distribution and is specially recommended for the Rolling Plains area of north-western Texas. In a four-year test conducted by the United States Department of Agriculture at experiment stations in the Middle West, the stands of Comanche raised from inoculated seed-grain averaged only 8·9 per cent. bunt compared with 38·9 and 65·1 for Kharkof and Chiefkan, respectively. Other desirable characters of Comanche include reasonably heavy cropping and excellent milling and baking qualities.

Dallman (A. A.). **Puccinia secalina Grove.** —*Northw. Nat.*, xviii, 3, p. 223, 1943.

In October, 1943, the aecidial stage of *Puccinia secalina* [*P. dispersa*], stated by W. B. Grove in The British Rust Fungi (Uredinales), 1913, to be very rare in Britain, was detected on the leaves of a few plants of *Lycopsis arvensis* scattered over a turnip and potato field near Doncaster (Yorks.).

Ullstrup (A. J.). **Further studies on a species of Helminthosporium parasitizing Corn.** —*Phytopathology*, xxxiv, 2, pp. 214-222, 2 figs., 1 graph, 1944.

Further studies are described on the fungus attacking maize throughout the Central Corn Belt of the United States, which was originally referred to *Helminthosporium maydis*, the imperfect stage of *Cochliobolus heterostrophus* [*R.A.M.*, xxi, p. 71], but has now been shown to be morphologically distinct and is designated *H. carbonum* n.sp., the specific epithet relating to the charred appearance of the diseased ears.

The straight or slightly curved, dark olivaceous-brown, 2- to 12- (mean 7) septate conidia measure 25 to 100 by 7 to 18 (62·6 by 13·2)μ, and are borne singly or in groups on conidiophores of the same colour, germination being effected by means of two polar germ-tubes. The species is divided into two morphologically indistinguishable races. Race I induces small, pale green or yellowish lesions in early infections, later developing into zonate spots, 5 by 20 mm., with dry, light brown centres and light to purplish-brown margins. The ears are infected through the tips, shanks, or directly through the husks. Race II caused the formation of lesions similar to those of Race I in the early stages, but when fully developed they are elongated, irregular, up to 3 by 20 mm., chocolate-brown in colour, and with less distinct zonation. The ears were more frequently attacked by this race than the leaves. During the five years of the author's observations on *H. carbonum*, no indication of an ascigerous stage has been detected.

Kulkarni (G. S.). **Baluchistan sulphur for Jowar smut** *Curr. Sci.*, xiii, 2, p. 48, 1944.

India being at present cut off from her normal foreign sources of sulphur supply, experiments have been conducted against *Sphacelotheca sorghi* on sorghum at the Gwalior Government Central Farm with the product of the Baluchistan mines, where the element occurs in a crude form in lumps, necessitating fine grinding before use as a seed dressing. The inoculated seed-grain (8 lb.) was divided into three equal lots, of which one was dusted with Baluchistan sulphur passed through a sieve of just over 100-mesh fineness, another with 200-mesh commercial flowers of sulphur, both at the rate of ½ oz. per 8 lb., and the third left untreated as a control. The incidence of smutted heads in the three lots was none out of 7,489, none out of 8,462, and 2,709 out of 8,703, respectively. It is apparent from these data that the home-produced sulphur, the purity of which is only about 56 per cent., is equally effective for the object in view with the 99 per cent. pure commercial brand.

Padwick (G. W.) & Mundkur (B. B.). **Kulkarni's note on Baluchistan sulphur.**—*Curr. Sci.*, xiii, 2, pp. 48–49, 1944.

In 1942–3, a comparative test was carried out with Baluchistan sulphur [see preceding abstract] and other fungicidal dusts against barley covered smut [*Ustilago hordei*] at a dosage of 1: 250 by weight in replicated plots at (A) Delhi and (B) Karnal, with the following results: (A) pure sulphur, formalin dust (6 per cent. formalin on charcoal dust), agrosan G. and Baluchistan sulphur 0·08, 0·00, 0·01, and 0·05 per cent. infection, respectively, with 1·20 in the untreated controls, and (B), 0·10, 0·04, 0·08, 0·08, and 1·44, respectively. In 1943, two different lots of sorghum seed, one (A) from Rohtak and the other (B) from Karnal, naturally infected by grain smut [*Sphacelotheca sorghi*], were dusted with Baluchistan sulphur, hand-picked before grinding and so raised to a purity of 75 per cent., and sown over areas of (A) 1 and (B) 11·5 acres, respectively, the untreated lots from the two districts covering 11 and 0·5 acres, respectively. No smut developed in either of the plots from the dusted seed, whereas the incidence in the (A) and (B) controls amounted to 9·8 and 2·1 per cent., respectively.

Frezzi (M. J.). **Podredumbre morena de los frutos cítricos y parásitos que la producen en Corrientes, Argentina.** [Brown rot of Citrus fruits and the parasites that produce it in Corrientes, Argentina.]—*Rev. argent. Agron.*, ix, 3, pp. 216–220, 2 pl., 1942. [Received June, 1944.]

The writer's observations on the brown rot of citrus fruits caused by *Phytophthora parasitica*, *P. citrophthora*, and *P. boehmeriae* in Argentina have already been noticed from other sources [*R.A.M.*, xxi, p. 195 and below, p. 296]. The fourth agent of the disease, *P. megasperma* [ibid., xi, p. 303; xiii, p. 25], was isolated in July, 1941, from sweet oranges in Bella Vista. The two first-named species are the most widely distributed and responsible for the heaviest losses. Under natural conditions the symptoms produced by the four fungi are indistinguishable.

Reid (W. D.). **Resistance of Poorman's Orange against Citrus canker (Pseudomonas citri Hasse).**—*N.Z. J. Sci. Tech.*, A, xxv, 4, pp. 170–173, 1943.

Previous investigations having revealed a very slight incidence of citrus canker (*Pseudomonas* [*Xanthomonas*] *citri*) in Poorman's Orange (New Zealand grapefruit) [pomelo / sour orange] in comparison with other species [*R.A.M.*, xvii, p. 813], further studies were undertaken to determine the basis of this apparent resistance to the disease. The results of field and greenhouse inoculation experiments showed Poorman's Orange to be approximately equal in susceptibility to canker with rough lemon and sweet orange, and its frequent escape from infection in the orchard is thought to rest rather on the temporary factors of age and condition of the foliage at the moment of infection than on any inherent resistance. In a citrus canker eradication campaign, therefore, it should be treated in the same way as species of recognized susceptibility.

Fawcett (H. S.), Perry (J. C.), & Johnston (J. C.). **The stubborn disease of Citrus.**—*Calif. Citrogr.*, xxix, 6, pp. 146–147, 3 figs., 1944.

A non-productive type of Washington Navel orange tree referred to as 'stubborn' was observed in the groves of the East Highlands Orange Company, California, after a performance record lasting from 1915 to 1917. When top-worked in 1921 with carefully selected buds such trees subsequently developed the same characteristics as the original trees. Navel oranges similarly affected were observed in the Redlands area in 1938. About 1924, Perry noted a condition of Navel orange fruits, then called 'pink nose', at East Highlands. This later became known as 'acorn' fruit [see next abstract], and was observed in the Redlands district and

elsewhere, especially in Eastern Los Angeles and San Bernardino counties. An abnormal type of branch growth was noted on the trees producing the 'acorn' fruit, which was suspected to be identical with grapefruit 'crazy top'. More recently, Navel orange trees of the 'stubborn' type with acorn-shaped fruit have been noted in eastern Los Angeles as far west as Azusa. In Arizona, workers had for long observed a similar condition known as 'pink nose' on grapefruit, accompanied by a growth condition called 'crazy top'. The 'stubborn' disease and the 'acorn' fruit in Navel oranges were thought to be distinct, until Johnston drew attention to the similarity of the foliage and branch characteristics of all these sets of trees. It was then observed that the 'acorn' fruit and the other symptoms were present on almost all the affected trees in all the localities referred to.

In 1938, five trees each were grown at the Citrus Experiment Station from buds of three 'stubborn' trees in the Redlands area. One progeny tree died, and the remaining 14 now (1944) show leaf and branch symptoms. One half of these were top-worked with healthy buds in 1942, and the shoots from these healthy buds now appear to be affected. In one case, the healthy buds were placed on a shoot from the originally healthy stock, on which a diseased Navel bud had grown, and these healthy Navel buds as they grew out also became affected. Other trees budded in 1938 at the Experiment Station from 'stubborn' trees in East Highlands are now small and dwarfed, with 'stubborn' symptoms. Pending further studies, it is pointed out that the disease of grapefruit in Arizona known as 'crazy top', with its accompanying 'acorn' fruit and 'blue albedo' may be the same disease.

The most constant characteristic of 'stubborn' disease is an abnormal type of foliage and branches. This generally becomes most evident in winter, when affected Navel trees tend to show an untimely autumn growth of small branches and leaves. More of the leaves appear to be broader and shorter and to bend upward more on each side of the midrib than is the case with healthy trees. The leaves generally become chlorotic and, at first, more numerous in a given space, owing to greater branching of the twigs; in severe cases, the leaves tend to fall more than on healthy trees. The growth of multiple buds and shorter internodes causes the trees to present a brush-like appearance. Fruiting gradually declines. The fruits are fewer, more irregular in size and shape, paler, and show more 'off-bloom' individuals than are found on healthy trees. Late in the season, some fruits usually show the 'acorn' shape. On these, the rind appears of normal texture, but uneven near the stem end, becoming abruptly thinner and smoother on the surface, till it is quite thin near the stylar end. This thinning may reach part or all of the stem end. In Navel fruits, the stylar or navel end assumes a pinkish colour.

In grapefruits, a blue colour is present in the albedo of the thin part of the rind; in severe cases, the pulp of the stylar end has a sour, disagreeable odour.

In view of the probable virus nature of the disease, care should be taken to avoid budding nursery trees with buds from affected trees.

Haas (A. R. C.), Klotz (L. J.), & Johnston (J. C.). **Acorn disease in Oranges.**—*Calif. Citrogr.*, xxix, 6, pp. 148, 168–169, 3 figs., 1944.

In 1937, a grower in West Ontario [California], observed a branch of one of his Navel orange trees bearing acorn-shaped fruits of poor quality [see preceding abstract]. By 1940, such branches and fruits had become numerous, and production declined alarmingly. An orchard near Redlands also showed the condition, to a striking extent.

The disease became more readily discernible with increasing maturity of the trees. In some years the shape of the diseased fruits resembled very much that of an acorn, the stem portion of the peel resembling the cap, while in others the symptom was much less evident. The blossom-end of the peel is of a lighter colour ('pink nose') than normal and very thin; it is subject to attack by fungi. Certain

branches tend to produce diseased fruits and others healthy, though eventually all branches bear only abnormal fruit. 'Acorn' fruits are of such poor quality that they have to be culled.

Affected trees show a marked loss of mature leaves, imparting to the uppermost portion of the tree an open appearance known as 'crazy top'. In the lower parts there is an excessive vegetative growth: mature leaves fall and multiple buds give rise to numerous short shoots with new leaves, the dense growth of young foliage persisting throughout the winter.

The juice of 'acorn' fruits had a more acid taste in the blossom half than in the stem half, which is the opposite to normal, while the amount of reducing sugars was greater in juice from the stem half than from the blossom half, which is again the reverse of normal. The juice in the tip halves of fruits from healthy trees contained more total sugars than that in the stem halves, whereas in 'acorn' fruit the juice from the tip halves contained far less than the stem halves. There was a marked reduction of dry matter in the peel of the tip halves of 'acorn' fruits. The appearance of 'acorn' fruits in diseased Navel orange trees budded over to Valencia orange (both the Navel sprouts and the Valencia top bearing 'acorn' fruits) suggests that the disease is due to a virus.

Blackford (F. W.). **Five minor fungous and virus diseases of Citrus.**—*Qd agric. J.*, lviii, 2, pp. 95–99, 3 figs., 1944.

In continuation of his earlier papers on citrus diseases in Queensland [*R.A.M.*, xxiii, p. 260], the author gives a brief account of five less important troubles, viz., collar rot due to various fungi [? chiefly *Phytophthora parasitica*: ibid., xvi, p. 451; xxii, p. 133], root rot due to *Armillaria* [*mellea*: ibid., xix, p. 24; xxi, p. 440], that due to *Ganoderma* sp. [ibid., xv, p. 280], psorosis [ibid., xxiii, p. 61], and pink disease [*Corticium salmonicolor*: ibid., xviii, p. 794; xx, p. 290].

A noteworthy feature of *Ganoderma* attack is the adherence of the soil to the bark of the roots, forming a sheath round them. The bark itself readily separates from the wood and the creamy, woolly growth of the mycelium is found beneath. The fungus has been found on old stumps of bloodwood [*Eucalyptus* spp.] and ironbark [*Eucalyptus* spp.] and from these is able to attack citrus growing near by. For the control of *A. mellea* and *Ganoderma* the author recommends thoroughly clearing the land and if possible sowing a green manure or other annual crop before planting. Treatment of the soil with carbon disulphide might also be tried.

Frezzi (M. J.). **Phytophthora boehmeriae, causante de la podredumbre morena de los frutos cítricos, en la Republica Argentina.** [*Phytophthora boehmeriae*, the agent of brown rot of Citrus fruits in the Argentine Republic.]—*Rev. argent. Agron.*, viii, 3, pp. 200–205, 3 figs., 1941. [Received June, 1944.]

Full details are given of the morphological characters of *Phytophthora boehmeriae*, the agent of a brown rot of sweet oranges new to Argentina, reference to which has already been made [*R.A.M.*, xxi, p. 185]. The dense, white, velvety, persistent mycelium developing on orange and lemon fruits inoculated with particles of 1 per cent. potato dextrose agar cultures of the fungus is readily distinguishable from the relatively sparse delicate growth of *P. parasitica* and *P. citrophthora* on the same hosts [see above, p. 294].

Progress Reports from Experiment Stations, season 1942–43.—181 pp., 6 graphs, 1 diag., London, Empire Cotton Growing Corporation, 1944.

These reports [cf. *R.A.M.*, xxii, p. 304] contain, *inter alia*, the following items of interest. At Bremersdorp, Swaziland, maize streak [ibid., xxi, p. 241], attacks of which have hitherto been slight, and confined to late-planted crops, showed a dis-

quieting increase. Highly resistant strains obtained from Barberton are to be bulked for late plantings and winter-grown crops.

Cotton angular leaf spot [*Xanthomonas malvacearum*] was scarcely noticeable in Southern Rhodesia.

The chief problems in the northern Gezira area of the Anglo-Egyptian Sudan were the leaf curl jassid [unspecified] and, to a less extent, blackarm. As the climate here is drier than it is to the south, blackarm [*X. malvacearum*] is less likely to be spread by wind-blown rain. The control measures in use have reduced the risk of crop failure, but in future more attention will be paid to Domains Sakel and the production from it of high quality selections resistant to jassid, blackarm, and leaf curl. In the southern Gezira, where rainfall is higher, the danger of a severe outbreak of blackarm is always present. X. 1730 A, once it has been established, tends to grow away from the disease, but it is not resistant, though under Gezira conditions, it is resistant to leaf curl. The control methods against blackarm, including the sweeping up and burning of debris, seed treatments with mercury dusts, and a sowing date delayed beyond what is considered the optimum by the Sudan Plantations Syndicate, are expensive and wasteful. R. L. Knight is directing work at Shambat towards producing blackarm-resistant strains of each variety, and promising material has been produced which contains one factor for resistance, but it will not be complete until at least one and perhaps two more factors for resistance have been added. When this very highly resistant material has been produced (it should be available for bulking in 1946–7), it is expected to replace the present material and so render unnecessary the present expensive control methods. A review of the entire Egyptian cotton selection work showed that progenies of the X. 1730 series were not superior to X. 1730 A, and therefore selection should be mainly confined to the new blackarm-resistant X. 1730 strains. Selections made in the present season from the blackarm-resistant X. 1730 L were very promising.

The derivatives X. 1730 A, G, H, and J are more strongly resistant to leaf curl in the Gezira than their original parent, X. 1730. These strains are at least as susceptible as Domains Sakel at Shambat. The N.T. series tested are all very resistant, including N.T. 2/38, N.T. 2/39, and N.T. 97/40, which have been used by Knight as parents in blackarm resistance transference. Lecrem, formerly selected by Massey for resistance, has retained this character. Massey's Domains Sakel, formerly alleged to be fully susceptible, has shown a definite response to selection for resistance.

In almost every locality where it was tested, BAR. X. 1730 L showed a marked increase in ginning outturn over X. 1730 A, but needs greater blackarm resistance by the inclusion of the factor B_3 before selection is undertaken. Though X. 1730 L was attacked by blackarm, it gave a final yield in one test of 5·42 kantars of seed cotton per feddan, in spite of the disease being given every advantage. In an adjacent plot, N.T. 2/40, also sown early, gave a seed cotton yield of 6·4 k. p.f. and showed conspicuous resistance to blackarm. Spinning tests on these blackarm-resistant strains gave promising results.

In genetics and breeding work at Shambat the addition of the *Gossypium punctatum* blackarm-resistance factor B_3 is being speeded up, both for N.T. 2 and X. 1730 types, and it is hoped to produce strains of these types containing both B_2 and B_3 within two years. A blackarm-resistance survey was made of most of the world's wild cottons. As resistance occurs both in the Old and New World diploids, it is possible that both forms of resistance can together be added to the New World cultivated types.

In Equatoria (Anglo-Egyptian Sudan) an examination of two variety tests six to eight weeks after sowing showed that X.A. 129 had by far the largest number of plants affected by blackarm. S.P. 84 and Deltapine each had about a quarter of the number, while 511 E and N.T. 43 37 had a tenth and a twentieth, respectively.

In preliminary work on blackarm resistance, it became evident that B_2 provides a very useful degree of resistance under Equatoria conditions. B_3 also seemed of value, but was available only in Sakel types, so that its value in American breeding work remains conjectural. A preliminary investigation of the value of B_2 made in Luluba by picking the resistant and susceptible plants separately in a plot of Uganda S.P. 84 showed that the resistant plants gave 14·4 per cent. more yield than the susceptible.

Conditions in Equatoria, particularly on the west bank of the Nile, do not favour a blackarm epidemic as much as the conditions do in Kordofan or the Gezira during the rains. The low temperatures in Equatoria greatly increase the incubation period of the disease, and plants sprayed with *X. malvacearum* at Maridi and Luluba took twice as long to show symptoms of the disease as they would have done in the Gezira. This alone considerably reduces rapidity of spread in Equatoria. In addition, lower temperatures delay germination and provide an added opportunity for any phage in the soil to destroy the organism. Rainfall in Equatoria, particularly on the west bank of the Nile, is usually almost vertical, and the sweeping 'horizontal' rain of the Gezira storms seldom, if ever, occurs. Thus, spread takes place by surface wash and rain splash off the ground; a small ridge of earth, sufficient to stop wash from one sub-plot to another, checked the spread of blackarm for several weeks. The climate of Equatoria also favours rapid disintegration of vegetable material, and no case suggestive of a carry-over of blackarm infection from a previous crop could be found. Where volunteer plants grew from wind-blown seed outside the cotton areas, the growth of tall grass round them screened them effectively. Examination of numerous native areas on the west bank of the Nile showed that the seed was the chief, if not the only, source of carry-over. All the areas were sown with resistant 511 D, and the average amount of primary or seed-borne infection was 0·8 per cent. As a result of all these factors, blackarm is unlikely ever to cause crop failures in Equatoria save in a very exceptional year.

In Uganda, attempts are being made to transfer resistance to blackarm and possibly to *Verticillium dahliae* from B. 181 to B.P. 52, while it is also desired, if possible, to transfer the high-yielding characters of the former. B.P. 52, which is locally the standard variety, is seriously contaminated, and steps are being taken to re-purify this strain for later distributions throughout the western half of Uganda. Breeding work has been designed primarily for the improvement of B.P. 52 in relation to blackarm. Secondary lines of work are the search for heritable resistance to *V. dahliae* and to its transference to B.P. 52.

Among the wide range of material collected at Serere in the last three years, the B_2 character for resistance in *G. hirsutum* types appears to have been found. None of the chief strains at Serere is homozygous susceptible.

Reddening of cotton leaves, possibly due to a soil deficiency, was very prevalent at Lubaga, Tanganyika Territory. Real damage was done to cotton on the experiment farm in patches by an *Alternaria*, probably *A. macrospora*. One block was badly affected early in April; the plants held on to the bottom bolls, but shed everything else, and remained stunted all the season. Where the attack was lighter, leaf-shedding was followed by healthy new growth. There was a slight indication of strain variation in susceptibility. A *Cercospora* leaf spot, probably *C. gossypina*, was widespread but not, apparently, serious on Lubaga cotton. Patchy infection by *Ramularia areola* caused leaf-drop in May.

Blackarm, seldom serious in Nyasaland, was rife in January over the whole cotton area. A statistical comparison between the relative susceptibilities of the local cottons was obtained by counts in the trials of two strains, C.L. 20 and C.L. 119. Apart from C.L. 20, which showed marked susceptibility, few of the local cottons showed as many as 20 per cent. of plants with stem lesions, and in view of the long dry season that prevails it is not likely that blackarm will ever become

serious in Nyasaland. Mz. 561 showed fair resistance, and C.L. 119 was scarcely affected.

Weindling (R.). **A technique for testing resistance of Cotton seedlings to the angular leaf spot bacterium.** *Phytopathology*, xxxiii, 2, pp. 235–239, 1 fig., 1944.

The technique devised by the writer at the South Carolina Agricultural Experiment Station for testing the resistance of cotton seedlings to angular leaf spot (*Phytomonas* [*Xanthomonas*] *malvacearum*) involved the inoculation of the seed of 20 varieties in suspensions of the pathogen for periods of five minutes and three hours and growing the resultant seedlings for three weeks at 27° to 35° C., the relative disease rating being based on the severity and speed of development of the lesions. In general, the varietal reactions of the seedlings tested under these conditions agreed with those of field plants. Thus, the percentages of infection in five representative varieties, viz.: S×P Egyptian (extremely susceptible), Shafter Acala (highly susceptible), Rogers' Acala (moderately susceptible), Stoneville 4–5 (tolerant), and Stoneville 4–8 (resistant), for the short and long inoculation periods were 100 and 100, 92 and 100, 48 and 86, 64 and 66, and 18 and 28, respectively, comparison of the more susceptible varieties being facilitated by the use of a disease index.

It will be noted that the Stoneville lines, unlike the other varieties tested, did not contract appreciably more infection after the longer inoculation period, which frequently resulted, however, in the appearance of necrotic spots on 4–8. This may point to the possession of a factor for resistance involving cotyledonary hypersensitivity, which would result in such rapid necrosis of the affected cells as to give the parasite little opportunity of producing the typical lesions. It is thought the method may serve as a rapid supplementary test in breeding disease-resistant varieties.

Drechsler (C.). **Three Hyphomycetes that capture nematodes in adhesive networks.**—*Mycologia*, xxxvi, 2, pp. 138–171, 5 figs., 1944.

The author gives technical diagnoses of three further fungi parasitic on nematodes [*R.A.M.*, xxii, pp. 386, 431], viz., *Arthrobotrys cladodes* var. *macroides* n.var., which occurs in decaying roots of *Viola tricolor* and in leaf mould in Maryland, and of *Dactylaria psychrophila* n.sp. on decaying leaves and stems of potato near Presque Isle, Maine. The third fungus is *A. arthrobotryoides*, which was isolated from leaf mould on deciduous wood near Presque Isle, Maine, and near Fairfax, Virginia.

Petch (T.). **Notes on entomogenous fungi.** *Trans. Brit. mycol. Soc.*, xxvii, 1–2, pp. 81–93, 1944.

In this further contribution [cf. *R.A.M.*, xxi, p. 451] the author describes observations on entomogenous fungi, including seven new species.

Emmons (C. W.). **Misuse of the name 'Trichophyton rosaceum' for a saprophytic Fusarium.**—*J. Bact.*, xlvii, 1, pp. 107–108, 1944.

The name '*Trichophyton rosaceum*' is stated to be commonly misapplied in laboratories engaged in the testing of fungicides to be used against dermatophytosis of the feet. For instance, of 12 fungi received at the United States Public Health Service from various laboratories, labelled '*T. rosaceum*', ten were strains of a rapidly growing, diffuse *Fusarium* producing lavender to blue and reddish-purple colonies and (within 48 hours) immense numbers of septate, crescent-shaped spores, one was *T. mentagrophytes*, and one appeared to be a Basidiomycete. Saprophytic species of *Fusarium* abound in the soil and may be isolated from slimy concrete

floors, or the error may have arisen through the accidental contamination of cultures. In any case, the spurious '*T. rosaceum*' should be replaced for fungicidal testing purposes by another dermatophyte, but not the authentic *T. rosaceum* Sabouraud 1910, the slow growth and scanty sporulation of which render it unfit for the object in view.

Ruschmann (G.) & Bartram (H.). **Further studies of the injury of Flax fibres and linen yarn by bacteria and fungi.**—*Bastfaser*, iii, pp. 29–39, 1943. [German. Abs. in *Chem. Abstr.*, xxxviii, 6, pp. 1370–1371, 1944.]

Experiments were conducted to determine the efficacy of trosilin (I.G. Farbenind.), chloramine, and clorina (Heyden) in the control of *Alternaria tenuis*, *Cladosporium herbarum*, and other organisms concerned in the spoilage of flax fibres and linen yarns in German spinning mills [*R.A.M.*, xxi, p. 453]. In the cold state, the preparations were found to be less effective sterilizers than water heated to 80° to 100° C., but when warmed they were far superior to the latter. At 80°, for instance, the contaminants were entirely eliminated by one hour's exposure to 0·5 per cent. trosilin, 1 per cent. clorina, or 2 per cent. chloramine. Fungi succumb more rapidly than bacteria to this method of sterilization.

Creager (D. B.). **Report of Gladiolus disease control studies.**—*Gladiolus*, xix, pp. 112–125, 1944. [Abs. in *Chem. Abstr.*, xxxviii, 6, pp. 1313–1314, 1944.]

Fusarium core and brown rots were shown by a survey of commercial gladiolus plantings in Illinois to be the most serious trouble in the State, the latter type of infection involving the bases, sides, and more rarely the tops of the bulbs [*R.A.M.*, xx, p. 468]. The disease may be combated, though complete elimination is impracticable, by six hours' immersion of the bulbs in 0·5 per cent. (1 pint in 25 gals.) cresol solution (12 to 14 hours for bulblets), or in a mixture of $\frac{3}{4}$ lb. new improved ceresan and 1 oz. dreft in 25 gals. water (five and 30 minutes for bulbs and bulblets, respectively). The ceresan solution should be discarded after one treatment. Planting should be carried out as soon as possible after disinfection. Mercuric chloride should only be used for the combined control of *F.* rots and scab [*Bacterium marginatum*], since the bulbs of certain varieties are susceptible to injury from this chemical.

Hoppe (P. E.). **Gladiolus seed treatment.**—*Gladiolus*, xix, pp. 126–127, 1944. [Abs. in *Chem. Abstr.*, xxxviii, 6, p. 1314, 1944.]

Lots of 100 seeds each from the open-pollinated Maid of Orleans gladiolus were treated with various fungicidal dusts in a preliminary experiment and planted out in the greenhouse. The germination percentages (at a maximum height of 6 in.) were as follows: control 58, new improved semesan jr. (1 per cent. ethyl mercury phosphate) 48, spergon (tetrachloro-para-benzoquinone) 61, and arasan (50 per cent. tetramethylthiuram disulphide) 71.

Mitra (A. K.). **A new Ascomycetous fungus on Selaginella.**—*Curr. Sci.*, xii, 12, p. 329, 1943.

An Ascomycete belonging to the order Sphaeriales and family Sphaeriaceae has been observed growing on living *Selaginella chrysocaulos* in the Lloyd Botanical Gardens, Darjeeling. It is characterized by minute, black, globose, smooth, ostiolate perithecia, oblong to spindle-shaped, hyaline, bicellular ascospores (eight per ascus), and paraphyses, and thus agrees with published descriptions of the genus *Melanopsamma*, of which it is considered to be a new species. The minute perithecia are found superficially in groups at the tips of the shoots or sporangiferous spikes, and an interesting feature of the fungus is the growth of its hyphae from the

tips downwards along the vascular bundles, leaving other parts of the stem unaffected.

FREZZI (M. J.). **Muerte del Tamarisco, ocasionado por 'Botryosphaeria tamaricis', en Corrientes, Argentina.** [Death of Tamarisk caused by '*Botryosphaeria tamaricis*' in Corrientes, Argentina.]—*Rev. argent. Agron.*, ix, 2, pp. 110–113, 1 pl., 2 figs., 1942.

Botryosphaeria tamaricis (Cke) Theiss. & Syd. (*Ann. mycol., Berl.*, xiii, 3–4, p. 663, 1915) was isolated in pure culture in 1 per cent. potato dextrose agar and other standard media from the leaden-coloured, subsequently darkening twigs of tamarisk (*Tamarix gallica*) in a 1½ to 2-year-old planting at Bella Vista, Corrientes, Argentina, which was entirely destroyed by the fungus early in 1941, this being the first record for the country. Pycnidia and perithecia are produced in abundance on diseased material in nature, but no fructifications developed in culture. The clavate asci, 55·5 to 83 by 15 to 21 μ, are furnished with a pedicel, 45 to 9·5 μ, and contain two types of ascospores, one elliptical, continuous, hyaline, with a rounded apex, 18·5 to 27·5 by 9 to 11·5 μ, and the other fusoid, continuous, hyaline, tapering to a point, 21 to 32 by 4·5 to 7 μ; the pycnidia are typical of *Dothiorella*, with pycnospores measuring 17 to 25·2 by 6 to 8·5 μ.

Positive results were given by inoculation experiments through wounded bark only.

HIRSCHORN (ELISA). **Una especie nueva del genero 'Tilletia' ('T. zundelii', n.sp.).** [A new species of the genus '*Tilletia*' ('*T. zundelii*', n.sp.).]—*Rev. argent. Agron.*, x, 2, pp. 186–189, 1 pl., 2 figs., 1943.

Tilletia zundelii n.sp. was found on *Setaria argentina* in Chaco, Argentina, causing hypertrophy of the ovaries and glumes. It is characterized by black, pulverulent sori, 4 to 11 by 3 to 4 μ, containing laminillae measuring 156 to 228 μ in diameter at the base and 78 to 99 μ at the apex, consisting of remnants of host tissue and enveloped by the fungus at various stages of development, with a profusion of hyaline cells and immature chlamydospores at the base; and globose chlamydospores 13 to 16 μ in diameter, with a dense, verrucose or dentate membrane, ½ to 1 μ thick. Attempts at chlamydospore germination were unsuccessful.

The presence of the above-mentioned laminillae in the sori, a feature which does not appear to have been described in connexion with *Tilletia*, raised some doubt as to the identity of the pathogen which was, however, referred to this genus by Dr. Zundel.

ORTON (C. R.). **Graminicolous species of Phyllachora in North America.**—*Mycologia*, xxxvi, 1, pp. 18–53, 1944.

This annotated list of 46 *Phyllachora* spp. on grasses in North America provides descriptions of each with synonyms, type locality, and geographical distribution, and gives a key to species and indices to species and hosts.

NORRIS (D. O.). **Pea mosaic on Lupinus varius L. and other species in Western Australia.**—*Bull. Coun. sci. industr. Res. Aust.* 170, 27 pp., 2 pl., 1 map, 1943. [Photo-lithographed.]

Descriptions are given of the symptoms induced by the pea mosaic virus on six species of lupin in Western Australia [*R.A.M.*, xxii, p. 469], namely, the closely related *Lupinus varius* and *L. pilosus*, which are considered together, *L. angustifolius*, *L. albus*, *L. mutabilis*, and *L. luteus* (sweet). On the two first-named, two distinct

phases of the disease may be observed: the primary develops 12 to 14 days after infection, when the young, semi-expanded leaves round the growing tip become markedly distorted, twisted, and abnormally pale, large, dark brown; necrotic spots appear on the leaflets, causing shrivelling and death, and light brown streaks on the stems and petioles, corresponding to necrosis of the underlying phloem tissue; unless the attack occurs late in the season, the flowers and pods are also involved, and seed production is inhibited or greatly reduced. After cessation of growth for a week or a fortnight, the diseased plants enter upon a well-defined secondary phase, characterized by the production of numerous new shoots from the axils of the upper part of the stem, which converts the top of the plant into a mass of spindly, erect shoots, up to 1 ft. in length, bearing dwarfed, malformed leaves and cupped, incurved leaflets, not exceeding ½ in. in length, imparting to the leaf the aspect of a partly closed hand. The name of 'bunchy top' is inevitably suggested by this striking phenomenon. The leaflets are brittle and show a conspicuous vein-clearing mottle, occasionally accompanied by slight interveinal necrosis. Small, misshapen flowers may be produced, the scanty resultant pods, their thick, fleshy walls covered with sharp pimples and irregular ridges, containing one or two apparently normal seeds of low viability. 'Bunchy-top' plants do not mature normally but remain green and vigorous after the healthy ones have died off, until killed by the onset of the dry summer season.

On *L. angustifolius*, which is being increasingly used as a green manure in Western Australia, the symptoms agree closely with those described under the name of 'sore skin' by Chamberlain from New Zealand [ibid., xv, p. 28]. The symptoms of the mosaic on *L. albus* first appear in the young growing tips and spread to the lower leaves, which tend to shrivel and droop as a result of stem-streaking. Affected plants may either rapidly become necrotic and die, or persist in a half-dead condition for an indefinite period. *L. mutabilis* sustains little damage apart from slight stunting, the conspicuous foliar marbling and mild rugosity developing a fortnight after infection, having no other consequences. This reaction makes *L. mutabilis* a useful host for differentiation between pea and cucumber mosaics, which induce identical symptoms on *L. angustifolius*, whereas on *L. mutabilis* the latter virus causes a severe necrotic streaking but no mottling. *L. luteus* appears to possess considerable resistance to pea mosaic, which attacks only a few plants even in stands closely surrounded by heavily diseased susceptible species. Affected individuals are dwarfed and erect, with small leaves and somewhat distorted leaflets bearing irregular, scattered, dark green, often 'blistered' islands. The lower leaves may die and hang down round the stem, which is sometimes superficially necrotic. As in the case of *L. varius*, diseased plants of *L. luteus* are apt to produce a number of secondary flower heads to replace the abortive primary ones, but the acute 'bunchy-top' phase typical of the former species never develops in the latter.

Seed transmission of the pea mosaic virus was shown not to occur either in lupins or subterranean clover, but is suspected to play an important part in the perpetuation of the disease in peas through the summer. Failure to infect peas by the use of sap from infected *L. varius* plants is attributed to the action of the lupin sap on the peas. The disease is transmitted to lupins chiefly from peas, broad beans, and sweet peas, other secondary annual hosts including, besides *Trifolium subterraneum*, *Medicago denticulata* and *Lathyrus tingitanus*, the stems and petioles of the last-named bearing superficial purplish-black streaks and lines extending into the older leaflets, where the interveinal areas between parallel lines are yellowish, producing a peculiar longitudinal, striated pattern. The perennial shrub, *Cassia corymbosa*, believed to be here recorded for the first time as a host of pea mosaic, carries the virus through the summer. The symptoms are so mild in nature as to be readily overlooked, consisting merely in dark green veinbanding of the

leaflets, though greenhouse inoculations resulted in severe stem streak and some foliar necrosis. *Hovea trisperma* was the only other perennial legume contracting pea mosaic in inoculation experiments.

Of the nine species of aphids shown to be capable of transmitting the virus, namely, *Myzus persicae*, *Aphis laburni*, *A. citricidis*, *Pentatrichopus tetrarhodus*, *Canariella aegopodii*, *Macrosiphum gei*, *M. rosae*, *A. gossypii*, and *Rhopalosiphum pseudobrassicae*, the first-named is likely to be the most important under Western Australian conditions.

In general, susceptibility to pea mosaic in lupins would appear to be correlated with a low alkaloid content, an increase in which involves a loss of palatability to the insect vectors, but this observation does not apply to the nearly alkaloid-free, highly resistant *L. luteus*.

No great economic importance need be ascribed to pea mosaic of lupins at present.

De Soriano (Angela M.). **Contralores microscópicos y microbiológicos en mantecas.** [Microscopic and microbiological counts in butter samples.]—*Rev. argent. Agron.*, ix, 3, pp. 193–203, 1942. [Received June, 1944.]

During a period of five months the writer conducted 1,465 analyses on 155 samples of butter from 24 Argentine dairies, using the two standard American methods of W. S. Greene (*Food Industr.*, September, 1935) and Wildman [*R.A.M.*, xvi, p. 536]. The former technique, which involves the enumeration of all the colonies produced on a plate culture by hyphae and spores, and not merely those of hyphal fragments exceeding a certain length, was found to be preferable for the object in view. An inverse relationship was found to exist between the yeast and mould populations of the samples, those poor in the former being rich in the latter and vice versa. The numbers of yeasts and moulds per ml. ranged from 0 to 100,000 and 0 to 225,000, respectively, for the products of the 24 dairies.

Tindale (G. B.). **Cool storage of Apples. Gas storage and skin coating experiments.**—*J. Dep. Agric. Vict.*, xlii, 3, pp. 124–129, 1944.

In experiments carried out in 1943 in Melbourne, Jonathan, Delicious, Rome Beauty, Stewart's Seedling, Democrat, and Granny Smith apples picked at three stages of maturity in March and April were promptly placed in gas storage and held there until late in December, all being covered with oiled wraps against superficial scald. Controls, also in oil wraps, were kept at the same temperatures in air, and in other tests the apples were given skin-coating treatments and then placed in ordinary cool storage at the same temperatures. In all the treatments, the Jonathan and Delicious apples were kept at 36° F. until the end of April, then at 34° to the end of May, and afterwards at 32°. The Rome Beauty, Stewart's Seedling, and Granny Smith apples were stored at 32° continuously in all tests.

Under all the conditions of storage, complete control of soft scald [*R.A.M.*, xxii, p. 316] and almost complete control of breakdown [ibid., xxii, p. 212] was obtained with the Jonathan variety, but breakdown was not controlled in Delicious. Further work demonstrated that much better control of breakdown resulted from storing at 40° until the end of April, at 36° during May, and at 32° subsequently. All the varieties kept much better in refrigerated gas storage than in air at the same temperature. In gas storage there was virtually no loss from disorders in Jonathan, Rome Beauty, and Granny Smith, but there was considerable breakdown in Delicious and Stewart's Seedling, the former variety also showing superficial scald. Gas storage increased the storage life of all varieties by about 50 per cent., as compared with air storage, while the skin-coatings increased the storage life by about 25 per cent. Two skin-coatings (castor-oil shellac and vac-guard) overcame Jonathan spot, and both, as well as spartan fruit emulsion, which was

the third form of coating used, appeared to equal oil wraps in overcoming superficial scald in Granny Smith.

It is concluded that, under Victorian conditions, 20 per cent. of the apple crop should be stored in 5 per cent. carbon dioxide for marketing in late October, November, and December. Granny Smith and Democrat apples are particularly suitable for this purpose. A large proportion of the remainder of the crop should be given a skin-coating treatment before being placed in cool storage.

JAHN (E.). **Untersuchungen zur Prüfung kupferfreier und kupferarmer Fusikladium-Bekämpfungsmittel im Laboratorium und bei künstlicher Infektion im Gewächshaus.** [Investigations on the testing of preparations containing no or little copper for *Fusicladium* control in the laboratory and by artificial inoculation in the greenhouse.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxiii, 4, pp. 457–481, 2 figs., 1 graph, 1943.

It was found practicable, in these experiments at the Biological Institute, Dahlem, Berlin, on the control of apple scab (*Fusicladium dendriticum*) [*Venturia inaequalis*: *R.A.M.*, xxii, p. 391] by means of sprays containing little or no copper, to preserve conidial inoculum, either from 80 per cent. beer wort agar cultures or from artificially infected leaves, for several months in a viable state at a temperature of 0° C. Conidial germination begins two hours after planting-out at a temperature range of 2° to 20° without significant deviations in the germination percentages either at this juncture or after longer periods. At 27° and 30° germination is much reduced, but on restoration to room temperature eight hours later, conidia exposed to the higher range proceeded to germinate almost normally. Satisfactory percentages of germination were obtained in distilled water at P_H4 and in tap water at $P_H6{\cdot}5$ to 8; no germination occurred at P_H9, but the conidia retained their viability. Germination was not affected by light, darkness, or the colour of the light (blue, green, yellow, or red) transmitted through glass filters. Appressorial formation, on the other hand, was stimulated by high-wave light. The conidia were not injured by desiccation on cover-slips for periods up to four days, or by the interruption of germination after 24 hours for a similar period of drying. The mycelium grew through a temperature range from 0° to 27°, with an optimum at 18° to 20° (P_H7), no development occurring at P_H8.

In greenhouse inoculation experiments on two- to three-year-old potted trees from selected stocks and open-pollinated seedlings, the uppermost two or three leaves contracted the maximum amount of infection, the older dark green leaves being less frequently attacked, and then principally at the bases or along the petiole. Fairly young cotyledonary leaves also proved susceptible. The time of year at which the experiments were conducted did not appear to affect the outcome. Neither temporary rises in temperature up to between 25° and 28° nor the transient desiccation of the conidial suspension used as inoculum interfered with the course of infection. Since the newly formed conidia do not invariably emerge in large numbers on the epidermis, staining of the leaves is often necessary to verify the success of the inoculation tests. A plant once attacked contracts further infection in each new series of trials. Generally speaking, control experiments in the greenhouse with preparations containing little or no copper (designated only by numbers) on the above-mentioned material yielded results agreeing with the laboratory data as to the effects of the same fungicides on conidial germination. There were, however, certain discrepancies between the degree of control afforded by a given preparation in different series of tests, as well as between the data obtained in greenhouse and field trials, in which pears were also treated against *F. pirinum* [*V. pirina*]. The wetting and adhesive properties of the sprays and their resistance to washing-off by rain are the properties to be chiefly considered in a comparative assessment of their efficacy in relation to environmental conditions.